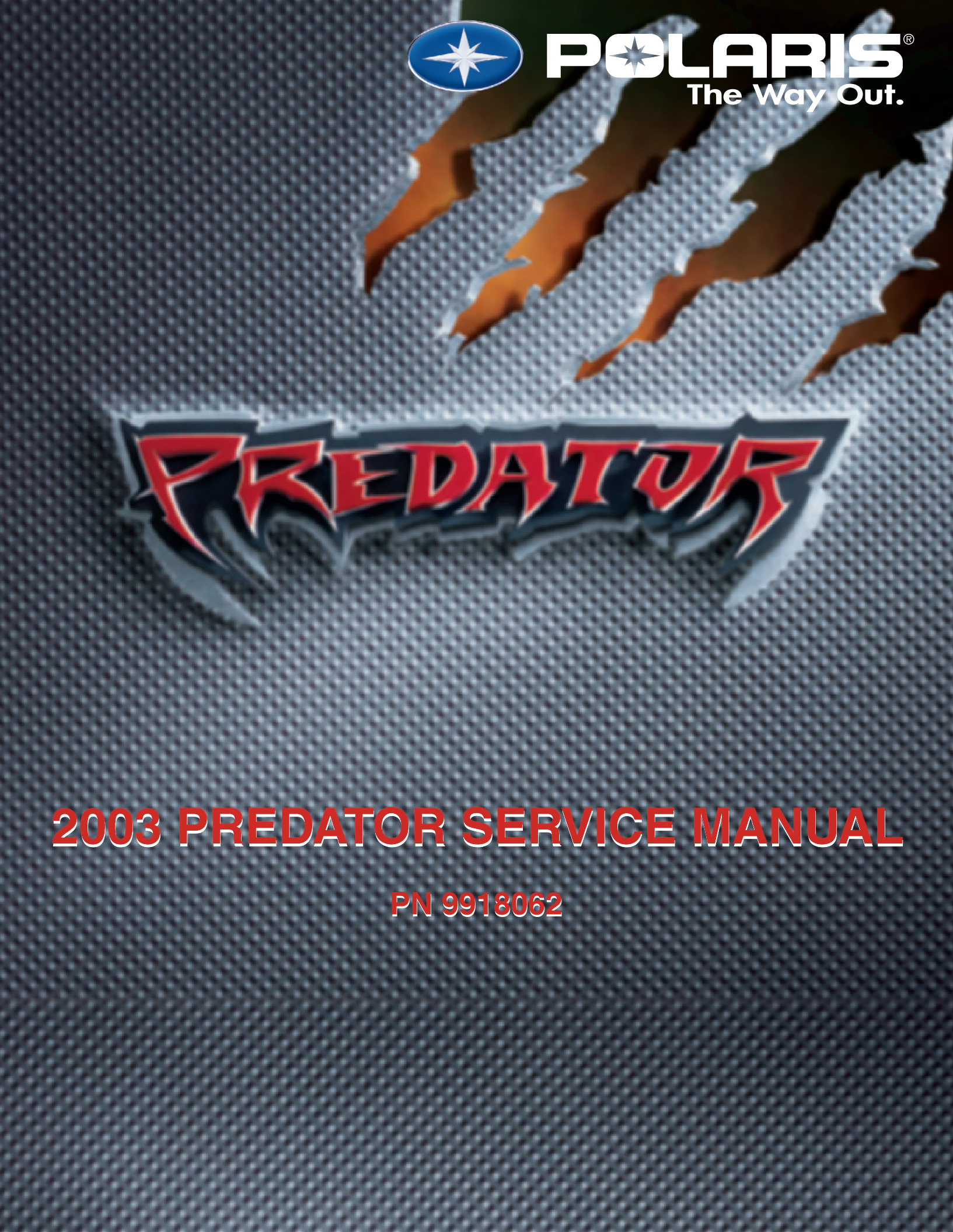


2003 PREDATOR SERVICE MANUAL

PN 9918062

POLARIS®
The Way Out.

2003 PREDATOR SERVICE MANUAL

Foreword

This manual is designed primarily for use by certified Polaris Master Service Dealer technicians in a properly equipped shop and should be kept available for reference. All references to left and right side of the vehicle are from the operator's perspective when seated in a normal riding position.

Some procedures outlined in this manual require a sound knowledge of mechanical theory, tool use, and shop procedures in order to perform the work safely and correctly. Technicians should read the text and be familiar with service procedures before starting the work. Certain procedures require the use of special tools. Use only the proper tools as specified.

This manual includes procedures for maintenance operations, component identification and unit repair, along with service specifications for the 2003 Polaris Predator ATV. Comments or suggestions about this manual may be directed to: Service Publications Dept. @ Polaris Sales Inc. 2100 Hwy 55 Medina Minnesota 55340.

2003 Polaris Predator ATV Service Manual (PN 9918062)

UNDERSTANDING SAFETY LABELS AND INSTRUCTIONS

Throughout these instructions, important information is brought to your attention by the following symbols:

The Safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

⚠ DANGER

Failure to follow DANGER instructions will result in severe injury or death to the operator, bystander or person inspecting or servicing the ATV.

⚠ WARNING

Failure to follow WARNING instructions could result in severe injury or death to the operator, bystander or person inspecting or servicing the ATV.

CAUTION:

A CAUTION indicates special precautions that must be taken to avoid personal injury, or ATV or property damage.

NOTE:

A NOTE provides key information to clarify instructions.

Trademarks

Polaris acknowledges the following products mentioned in this manual:

Loctite, Registered Trademark of the Loctite Corporation
FOX, Registered Trademark of Fox Shox
Fluke, Registered Trademark of John Fluke Mfg. Co.
Mity Vac, Registered Trademark of Neward Enterprises, Inc.

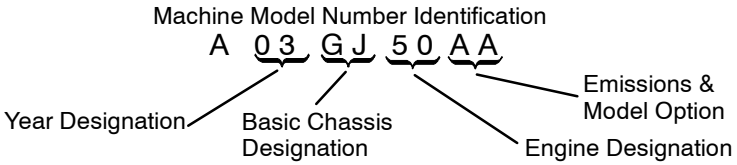
CHAPTER INDEX

CHAPTER 1
GENERAL INFORMATION

1

MODEL IDENTIFICATION

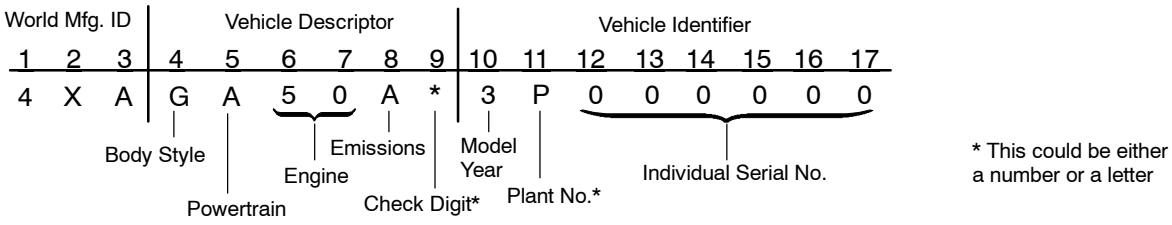
The machine model number must be used with any correspondence regarding warranty or service.



ENGINE DESIGNATION NUMBER

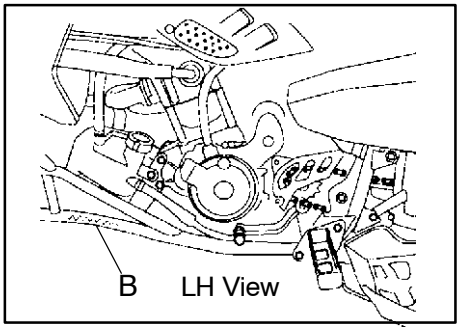
ES50PLE01 . . . . . Single, Water Cooled, Electric Start, Manual 5-Speed, DOHC 4 Stroke

VIN IDENTIFICATION



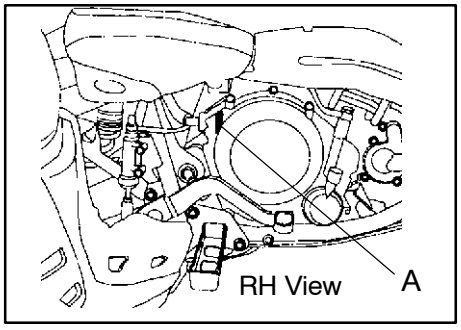
UNIT MODEL NUMBER AND SERIAL NUMBER LOCATION

Whenever corresponding with Polaris about a particular issue, the machine model number and serial number are important for vehicle identification. The machine serial number is stamped on the lower left side of the frame tube.(B)



ENGINE SERIAL NUMBER LOCATION

This information can be found on the clutch housing on the left side of engine.(A)



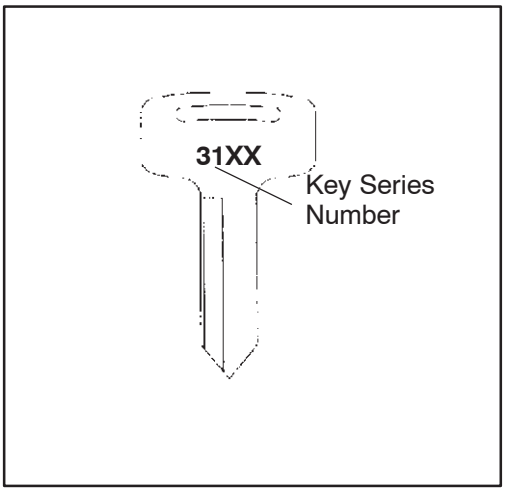
PUBLICATION NUMBERS

Year	Model	Model No.	Owner's Manual PN	Parts Manual PN	Parts Micro Fiche PN
2003	PREDATOR	A03GJ50CA	9917574	9917576	9917577

NOTE: When ordering service parts be sure to use the correct parts manual.

REPLACEMENT KEYS

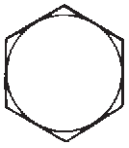
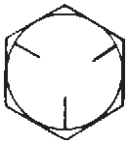
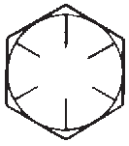
Replacement keys can be made from the original key. To identify which series the key is, take the first two digits on the original key and refer to the chart to the right for the proper part number. Should both keys become lost, replacement of the ignition switch assembly is necessary.



Series #	Part Number
20	4010278
21	4010278
22	4010321
23	4010321
27	4010321
28	4010321
31	4110141
32	4110148
67	4010278
68	4010278

STANDARD TORQUE SPECIFICATIONS

The following torque specifications are to be used as a general guideline. **FOR SPECIFIC TORQUE VALUES OF FASTENERS Refer to exploded views in the appropriate section.** There are exceptions in the steering, suspension, and engine sections.

Bolt Size	Threads/In	Grade 2	Grade 5	Grade 8
		Torque in. lbs. (Nm)		
#10 -	24	27 (3.1)	43 (5.0)	60 (6.9)
#10 -	32	31 (3.6)	49 (5.6)	68 (7.8)
		Torque ft. lbs. (Nm)*		
1/4 -	20	5 (7)	8 (11)	12 (16)
1/4 -	28	6 (8)	10 (14)	14 (19)
5/16 -	18	11 (15)	17 (23)	25 (35)
5/16 -	24	12 (16)	19 (26)	29 (40)
3/8 -	16	20 (27)	30 (40)	45 (62)
3/8 -	24	23 (32)	35 (48)	50 (69)
7/16 -	14	30 (40)	50 (69)	70 (97)
7/16 -	20	35 (48)	55 (76)	80 (110)
1/2 -	13	50 (69)	75 (104)	110 (152)
1/2 -	20	55 (76)	90 (124)	120 (166)

Metric / Torque	6 x 1.0.	72-78 In. lbs.	8 x 1.25	14-18 ft. lbs	10 x 1.25	26-30 ft. lbs.

PREDATOR MODELS

PREDATOR 500

TROY LEE LIMITED EDITION
PREDATOR 500

MODEL: ..... 2003 PREDATOR 500
MODEL NUMBER: . A03GJ50AA
ENGINE MODEL: .. ES50PLX

Catagory	Dimension
Length	**71.5 in./182 cm**
Width	**47.5 in./121 cm**
Height	**45 in./114 cm**
Seat Height	**32 in./81.28 cm**
Wheel Base	**51 in./130 cm**
Ground Clearance	**4.5 in./11 cm**
Dry Weight	**415 lbs./188 kg**
Fuel Capacity	**3.25 gal./12.3 ltr**
Oil Capacity	**2.25 qts./2.1 ltr**
Coolant Capacity	**2.25 qts./2.1 ltr**


Dune Package Shown

MODEL: ..... 2003 PREDATOR 500
MODEL NUMBER: . A03GJ50AA
ENGINE MODEL: .. ES50PLE01

Engine	
Platform	Fuji DOHC 4 stroke
Engine Model Number	ES50PLE01
Engine Displacement	499cc
Number of Cylinders	1
Bore & Stroke (mm)	99.2 x 64.6 mm
Compression Ratio	10.8:1
Compression Pressure	130 psi
Engine Idle Speed	1600 Rpm
Cooling System	Liquid
Thermostat Opening Temperature	160°F (71°C)
Overheat Warning	High Temp Light
Lubrication	Pressurized Dry Sump
Oil Requirements	PS-4 Synthetic
Exhaust System	2 to 1 canister style
Carburetion	
Carburetor model	Mikuni BSR 42mm
Main Jet	150
Pilot jet	45
Jet Needle	6CGY07-060-3
Needle Jet	O-OM
Pilot Screw	2.5 Turns Out
Pilot Air Jet	110
Float Height	13-14 mm (0.51-0.55“)
Fuel Delivery	Fuel Pump
Fuel Requirement	87 Octane (minimum)
Electrical	
Alternator Output	200 w @ 3000 RPM
Voltage Regulator	3-Phase PN 4010654
Lghts : Main Headlights	Dual Beam 35 watts / 35 watts
Tail	8.26 watts
Brake	26.9 watts
Neutral / Hot Indicator lights	1 watt (ea.)
Ignition System	DC/CDI Ignition
RPM Limit	9005
Ignition Timing	30° ± 3° BTDC @ 3500 RPM
Spark plug / Gap	NGK DCPR8E/ .035 in./ 0.9 mm
Battery / Model / Amp Hr	Maintenance-Free Yuasa YTX9 9 Amp Hr
Circuit Breakers	Fan 10 amp / Harness 20 amp
Starting	Electric - Standard
Instrument Cluster	N/A

Drivetrain		
Transmission Type		Manual 5 speed
Main Sprocket - # Tooth		14
Rear Sprocket - # Tooth		37
Axle Runout - Maximum		.020” (.51 mm)
Gear Ratio :	1st	2.615
	2nd	1.765
	3rd	1.350
	4th	1.091
	5th	0.958
	Primary	2.792
Chain Size / Deflection		520 O-ring
Clutch Type		Wet Multi Plate
Clutch Lever Freeplay		1/8″ - 3/16″ / 3.1 - 4.7 mm
Steering / Suspension		
Front Suspension Style / Shock		Dual A-arm / Fox Shock
Front Travel		10 in. / 25.4 cm
Rear Suspension Style / Shock		Linkless Swing Arm / Fox Shock w/ remote reservoir
Rear Travel		11 in. / 27.94 cm
Ground Clearance		4.5 in. / 11.43 cm
Shock Preload Adjustment Front / Rear		Front - Spring tension - Std. Rear - Fox Dual Clicker - Std.
Turning Radius		67 in. / 170.18 cm
Toe Out		0 - 1/16 in / .0 - .159 cm
Wheels / Brakes		
Wheel Size - Front		21x7-10 Aluminum
Wheel Size - Rear		20x11-10 Aluminum
Front Tire Make / Model / Size		Maxxis Razr 21x7-10
Rear Tire Make / Model / Size		Maxxis Razr 20x11-10
Recommended Air Pressure F / R		5 psi Front 5 psi Rear
Brake - Front		Dual Hydraulic Disc
Brake - Rear		Single Hydraulic Disc

JETTING CHART

Altitude		AMBIENT TEMPERATURE	
		Below 40°F Below 5°C	+40°F to +80°F +5°C to +28°C
Meters (Feet)	0-1800 (0-6000)	155	150
	above 1800 (above 6000)	147.5	142.5

SAE TAP DRILL SIZES

Thread Size	Drill Size	Thread Size	Drill Size
#0-80	3/64	1/2-13	27/64
#1-64	53	1/2-20	29/64
#1-72	53	9/16-12	31/64
#2-56	51	9/16-18	33/64
#2-64	50	5/8-11	17/32
#3-48	5/64	5/8-18	37/64
#3-56	45	3/4-10	21/32
#4-40	43	3/4-16	11/16
#4-48	42	7/8-9	49/64
#5-40	38	7/8-14	13/16
#5-44	37	1-8	7/8
#6-32	36	1-12	59/64
#6-40	33	1 1/8-7	63/64
#8-32	29	1 1/8-12	1 3/64
#8-36	29	1 1/4-7	1 7/64
#10-24	24	1 1/4-12	1 11/64
#10-32	21	1 1/2-6	1 11/32
#12-24	17	1 1/2-12	1 27/64
#12-28	4.6mm	1 3/4-5	1 9/16
1/4-20	7	1 3/4-12	1 43/64
1/4-28	3	2-4 1/2	1 25/32
5/16-18	F	2-12	1 59/64
5/16-24	I	2 1/4-4 1/2	2 1/32
3/8-16	O	2 1/2-4	2 1/4
3/8-24	Q	2 3/4-4	2 1/2
7/16-14	U	3-4	2 3/4
7/16-20	25/64		

METRIC TAP DRILL SIZES

Tap Size	Drill Size	Decimal Equivalent	Nearest Fraction
3 x .50	#39	0.0995	3/32
3 x .60	3/32	0.0937	3/32
4 x .70	#30	0.1285	1/8
4 x .75	1/8	0.125	1/8
5 x .80	#19	0.166	11/64
5 x .90	#20	0.161	5/32
6 x 1.00	#9	0.196	13/64
7 x 1.00	16/64	0.234	15/64
8 x 1.00	J	0.277	9/32
8 x 1.25	17/64	0.265	17/64
9 x 1.00	5/16	0.3125	5/16
9 x 1.25	5/16	0.3125	5/16
10 x 1.25	11/32	0.3437	11/32
10 x 1.50	R	0.339	11/32
11 x 1.50	3/8	0.375	3/8
12 x 1.50	13/32	0.406	13/32
12 x 1.75	13/32	0.406	13/32

DECIMAL EQUIVALENTS

1/64 0156
1/32 . . . . . .0312 . . . 1 mm = .0394″
3/64 0469
1/16 0625
5/64 . . . . . .0781 . . . 2 mm = .0787″
3/32 0938
7/64 . . . . . .1094 . . . 3 mm = .1181″
1/8. 1250
9/64 1406
5/32 . . . . . .1563 . . . 4 mm = .1575″
11/64 1719
3/16 . . . . . .1875 . . . 5 mm = .1969″
13/64 2031
7/32 2188
15/64 . . . . . .2344 . . . 6 mm = .2362″
1/4 25
17/64 . . . . . .2656 . . . 7 mm = .2756″
9/32 2813
19/64 2969
5/16 . . . . . .3125 . . . 8 mm = .3150″
21/64 3281
11/32 . . . . . .3438 . . . 9 mm = .3543″
23/64 3594
3/8 375
25/64 . . . . . .3906 . . . 10 mm = .3937″
13/32 4063
27/64 . . . . . .4219 . . . 11 mm = .4331″
7/16 4375
29/64 4531
15/32 . . . . . .4688 . . . 12 mm = .4724″
31/64 4844
1/2 . . . . .5 . . . . . 13 mm = .5118
33/64 5156
17/32 5313
35/64 . . . . . .5469 . . . 14 mm = .5512″
9/16 5625
37/64 . . . . . .5781 . . . 15 mm = .5906″
19/32 5938
39/64 6094
5/8 . . . . .625 . . . . . 16 mm = .6299″
41/64 6406
21/32 . . . . . .6563 . . . 17 mm = .6693″
43/64 6719
11/16 6875
45/64 . . . . . .7031 . . . 18 mm = .7087″
23/32 7188
47/64 . . . . . .7344 . . . 19 mm = .7480″
3/4 75
49/64 7656
25/32 . . . . . .7813 . . . 20 mm = .7874″
51/64 7969
13/16 . . . . . .8125 . . . 21 mm = .8268″
53/64 8281
27/32 8438
55/64 . . . . . .8594 . . . 22 mm = .8661″
7/8 875
57/64 . . . . . .8906 . . . 23 mm = .9055″
29/32 9063
59/64 9219
15/16 . . . . . .9375 . . . 24 mm = .9449″
61/64 9531
31/32 . . . . . .9688 . . . 25 mm = .9843
63/64 9844
1 . . . . . 1.0

CONVERSION TABLE

Unit of Measure	Multiplied by	Converts to
ft. lbs.	x 12	= in. lbs.
in. lbs.	x .0833	= ft. lbs.
ft. lbs.	x 1.356	= Nm
in. lbs.	x .0115	= kg-m
Nm	x .7376	= ft. lbs.
kg-m	x 7.233	= ft. lbs.
kg-m	x 86.796	= in. lbs.
kg-m	x 9.807	= Nm
in.	x 25.4	=mm
mm	x .03937	= in.
in.	x 2.54	= cm
mile (mi.)	x 1.6	= km
km	x .6214	= mile (mi.)
Ounces (oz)	x 28.35	= Grams (g)
Fluid Ounces (fl. oz.)	x 29.57	= Cubic Centimeters (cc)
Cubic Centimeters (cc)	x .03381	= Fluid Ounces (fl. oz.)
Grams (g)	x 0.035	= Ounces (oz)
lb.	x .454	= kg
kg	x 2.2046	= lb.
Cubic inches (cu in)	x 16.387	= Cubic centimeters (cc)
Cubic centimeters (cc)	x 0.061	= Cubic inches (cu in)
Imperial pints (Imp pt)	x 0.568	= Liters (l)
Liters (l)	x 1.76	= Imperial pints (Imp pt)
Imperial quarts (Imp qt)	x 1.137	= Liters (l)
Liters (l)	x 0.88	= Imperial quarts (Imp qt)
Imperial quarts (Imp qt)	x 1.201	= US quarts (US qt)
US quarts (US qt)	x 0.833	= Imperial quarts (Imp qt)
US quarts (US qt)	x 0.946	= Liters (l)
Liters (l)	x 1.057	= US quarts (US qt)
US gallons (US gal)	x 3.785	=Liters (l)
Liters (l)	x 0.264	= US gallons (US gal)
Pounds - force per square inch (psi)	x 6.895	= Kilopascals (kPa)
Kilopascals (kPa)	x 0.145	= Pounds - force per square inch (psi)
Kilopascals (kPa)	x 0.01	= Kilograms - force per square cm
Kilograms - force per square cm	x 98.1	= Kilopascals (kPa)
π (3.14) x R^2 x H (height)		= Cylinder Volume

°C to °F: 9 (°C + 40) ÷ 5 - 40 = °F
°F to °C: 5 (°F + 40) ÷ 9 - 40 = °C

GLOSSARY OF TERMS

ABDC: After bottom dead center.
ACV: Alternating current voltage.
Alternator: Electrical generator producing voltage alternating current.
ATDC: After top dead center.
BBDC: Before bottom dead center.
BDC: Bottom dead center.
BTDC: Before top dead center.
CC: Cubic centimeters.
Center Distance: Distance between center of crankshaft and center of driven clutch shaft.
Chain Pitch: Distance between chain link pins (No. 35 = 3/8″ or 1 cm). Polaris measures chain length in number of pitches.
CI: Cubic inches.
Clutch Buttons: Plastic bushings which aid rotation of the movable sheave in the drive and driven clutch.
Clutch Offset: Drive and driven clutches are offset so that drive belt will stay nearly straight as it moves along the clutch face.
Clutch Weights: Three levers in the drive clutch which relative to their weight, profile and engine RPM cause the drive clutch to close and grip the drive belt.
Crankshaft Run-Out: Run-out or "bend" of crankshaft measured with a dial indicator while crankshaft is supported between centers on V blocks or resting in crankcase. Measure at various points especially at PTO.
DCV: Direct current voltage.
Dial Bore Gauge: A cylinder measuring instrument which uses a dial indicator. Good for showing taper and out-of-round in the cylinder bore.
Electrical Open: Open circuit. An electrical circuit which isn't complete.
Electrical Short: Short circuit. An electrical circuit which is completed before the current reaches the intended load. (i.e. a bare wire touching the chassis).
End Seals: Rubber seals at each end of the crankshaft.
Engagement RPM: Engine RPM at which the drive clutch engages to make contact with the drive belt.
ft.: Foot/feet.
Foot Pound: Ft. lb. A force of one pound at the end of a lever one foot in length, applied in a rotational direction.
g: Gram. Unit of weight in the metric system.
gal.: Gallon.
ID: Inside diameter.
in.: Inch/inches.
Inch Pound: In. lb. 12 in. lbs. = 1 ft. lb.
kg/cm^2 : Kilograms per square centimeter.
kg-m: Kilogram meters.
Kilogram/meter: A force of one kilogram at the end of a lever one meter in length, applied in a rotational direction.
l or ltr: Liter.
lbs/in^2 : Pounds per square inch.
Left or Right Side: Always referred to based on normal operating position of the driver.
m: Meter/meters.
Mag: Magneto.
Magnetic Induction: As a conductor (coil) is moved through a magnetic field, a voltage will be generated in the windings. Mechanical energy is converted to electrical energy in the stator.
mi.: Mile/miles.
mm: Millimeter. Unit of length in the metric system. 1mm = approximately .040″.
Nm: Newton meters.
OD: Outside diameter.
Ohm: The unit of electrical resistance opposing current flow.
oz.: Ounce/ounces.
Piston Clearance: Total distance between piston and cylinder wall.
psi.: Pounds per square inch.
PTO: Power take off.
PVT: Polaris Variable Transmission (Drive Clutch System)
qt.: Quart/quarts.
Regulator: Voltage regulator. Regulates battery charging system output at approx. 14.5 DCV as engine RPM increases.
Reservoir Tank: The fill tank in the liquid cooling system.
Resistance: In the mechanical sense, friction or load. In the electrical sense, ohms, resulting in energy conversion to heat.
RPM: Revolutions per minute.
Seized Piston: Galling of the sides of a piston. Usually there is a transfer of aluminum from the piston onto the cylinder wall. Possible causes: 1) improper lubrication; 2) excessive temperatures; 3) insufficient piston clearance; 4) stuck piston rings.
Stator Plate: The plate mounted under the flywheel supporting the battery charging coils.
TDC: Top dead center. Piston's most outward travel from crankshaft.
Volt: The unit of measure for electrical pressure of electromotive force. Measured by a voltmeter in parallel with the circuit.
Watt: Unit of electrical power. Watts = amperes x volts.
WOT: Wide open throttle.

NOTES

CHAPTER 2
MAINTENANCE

PERIODIC MAINTENANCE CHART

Inspection, adjustment and lubrication intervals of important components are listed in the following chart. Maintenance intervals are based upon average riding conditions and vehicle speed.

The following symbols denote potential items to be aware of during maintenance:

■= **CAUTION: Due to the nature of these adjustments, it is recommended this service be performed by an authorized Polaris dealer.**

▶= **SEVERE USE ITEM --If vehicle is subjected to severe use, decrease interval by 50%** ***(Severe Use is defined as frequent vehicle immersion in mud, water or sand, racing or race-style high rpm use, manual slipping of the clutch prolonged low speed - heavy load operation or extended idle. More preventative maintenance is required under these conditions. Fluid changes, cable, chain and chassis lubrication are required more frequently. For engine oil, short trip cold weather riding also constitutes severe use. Pay special attention to oil level. A rising oil level in cold weather can indicate contaminants collecting in the oil sump or crankcase. Change oil immediately and monitor level. If oil level begins to rise, discontinue use and determine cause.***

E= Emission Control System Service (California).

NOTE: Inspection may reveal the need for replacement parts. Always use genuine Polaris parts.

ENGINE / COOLING / CONTROLS							
Item				**Maintenance Interval (Whichever comes first)**			**Remarks**
				Hours	**Calendar**	**Miles (Km)**	
▶		E	Engine Oil - Level/Change	10 hrs	-	100 (160)	Check level pre-ride Break-In service at 1 hour
▶		E	Oil Filter	10 hrs	-	100 (160)	Replace with oil change
▶		E	Air Filter - Pre-Filter	Daily	Daily	-	Inspect, clean more often in dirty or wet conditions
▶		E	Air Filter - Main Element	Weekly	Weekly	-	Inspect - Replace if necessary
▶			Air Box Sediment Tube	-	Daily	-	Drain deposits whenever visible
▶			Engine Breather Filter	20 hrs	Monthly	200 (320)	Inspect and clean if necessary
		E	Idle Speed	As required	As required	-	Adjust as required
	■		Throttle Cable / ETC Switch	50 hrs	6 months	500 (800)	Inspect -Adjust, Lubricate, Replace if necessary
			Choke (Enricher) Cable	50 hrs	6 months	500 (800)	Inspect -Adjust, Lubricate, Replace if necessary
			Carburetor Float Bowl	50 hrs	6 months	500 (800)	Drain bowl periodically and prior to storage
			Carburetor Air Intake Ducts/Flange	50 hrs	6 months	500 (800)	Inspect all ducts for proper sealing/air leaks
	■	E	Fuel System	100 hrs	12 months	1000 (1600)	Check for leaks at tank cap, lines, fuel valve, filter, pump & carburetor. Replace lines every 2 years.
			Coolant/Level Inspection	Daily	Daily		Replace engine coolant every 2 years
			Coolant Strength / System Pressure Test	100 hrs	6 months	1000 (1600)	Inspect strength seasonally; Pressure test system annually
▶			Radiator	100 hrs	12 months	1000 (1600)	Inspect / Clean external surfaces
▶			Cooling and Oil System Hoses	100 hrs	12 months	1000 (1600)	Pre-ride / Inspect for leaks
▶			Engine Mounts	100 hrs	12 months	1000 (1600)	Pre-ride / Inspect
			Exhaust Muffler / Pipe	100 hrs	12 months	1000 (1600)	Pre-ride / Inspect

PERIODIC MAINTENANCE CHART CONT'D

ELECTRICAL							
Item				Maintenance Interval (Whichever comes first)			Remarks
		E	Spark Plug	100 hrs	12 months	1000 (1600)	Inspect - Replace if necessary
▶			Wiring	100 hrs	12 months	1000 (1600)	Inspect for abrasion, routing, security. Apply Dielectric grease to connectors that are subjected to water, mud, etc.
	■		Ignition Timing	100 hrs	12 months	1000 (1600)	Inspect
▶			Battery	20 hrs	Monthly	200 (320)	Check terminals; Clean; Test
			Headlight Aim	As required	As required	-	Adjust as Necessary
			Headlamp Inspection	Daily	Daily	-	Check operation daily; Apply dielectric grease whenever lamp is replaced
			Tail Lamp Inspection	Daily	Daily	-	Check operation daily; Apply dielectric grease whenever lamp is replaced

CHASSIS / SUSPENSION / BRAKE							
Item				Maintenance Interval (Whichever comes first)			Remarks
				Hours	Calendar	Miles (Km)	
▶			General Lubrication	50 hrs	3 months	500 (800)	Lubricate All Fittings, Pivots, Cables, Etc.
			Drive Chain	Pre-ride	Pre-ride	Pre-ride	Clean and Inspect, Adjust, Lubricate
	■		Steering	Pre-ride	Pre-ride	Pre-ride	Inspect Daily, Lubricate
	■		Toe Adjustment	As required	As required	-	Periodic Inspection, Adjust Whenever Parts are Replaced
▶			Front Suspension	Pre-ride	Pre-ride	Pre-ride	Inspect - Lubricate
▶			Rear Suspension	Pre-ride	Pre-ride	Pre-ride	Inspect - Lubricate
			Tires	Pre-ride	Pre-ride	-	Inspect Daily, Pre-Ride Inspection Item
	■		Brake Fluid	200 hrs	24 months	2000 (3200)	Change Every Two Years
▶			Brake Fluid Level	Pre-ride	Pre-ride	-	Inspect Sight Glass Daily Pre-Ride Inspection Item
▶			Brake Lever Travel	Pre-ride	Pre-ride	-	Inspect Daily Pre-Ride Inspection Item
▶	■		Brake Pad Wear	10 hrs	Monthly	100 (160)	Inspect Periodically
			Brake Adjustment	As required	As required	-	Inspect Deflection Daily; Adjust
			Brake System	Pre-ride	Pre-ride	-	Pre-Ride Inspection Item
			Wheels / Fasteners	Pre-ride	Pre-ride	-	Pre-Ride Inspection Item
			Frame Nuts, Bolts, Fasteners	Pre-ride	Pre-ride	-	Pre-Ride Inspection Item

PRE-RIDE / DAILY INSPECTION

Perform the following pre-ride inspection daily, and when servicing the vehicle at each scheduled maintenance.

- Tires - check condition and pressures
- Fuel and oil tanks - fill both tanks to their proper level; Do not overfill oil tank
- All brakes - check operation and adjustment (includes auxiliary brake)
- Throttle - check for free operation
- Headlight/Taillight/Brakelight - check operation of all indicator lights and switches
- Engine stop switch - check for proper function
- Wheels - check for loose wheel nuts and axle nuts; check to be sure axle nuts are secured by cotter pins
- Air cleaner element - check for dirt or water; clean or replace
- Steering - check for free operation, noting any unusual looseness in any area
- Loose parts - visually inspect vehicle for any damaged or loose nuts, bolts or fasteners
- Engine coolant - check for proper level at the recovery bottle

RECOMMENDED PRE-RIDE FLUID LEVEL CHECKS

Item	Type	Notes	See Pages
Engine Oil / Transmission	Polaris PS 4 Synthetic	Add to proper level on dipstick.	2.18
Coolant / Level	Polaris Premium 60/40 Pre-mixed Antifreeze/ Coolant or a 50/50 mixture high quality antifreeze/ coolant and distilled water	Allow engine and cooling system to cool completely and check level in radiator. Fill to top of filler neck. If reservoir was empty or extremely low, fill radiator before filling reservoir tank to full line.	2.15
Brake Fluid	Polaris DOT 3 Brake Fluid	Fill to indicated level inside reservoir. Sight glass should appear dark when installed, indicating proper fluid level.	2.22

NOTE: Quick Reference Lubricants and maintenance product part numbers are listed on page 2.5

POLARIS LUBRICANTS,MAINTENANCE AND SERVICE PRODUCTS

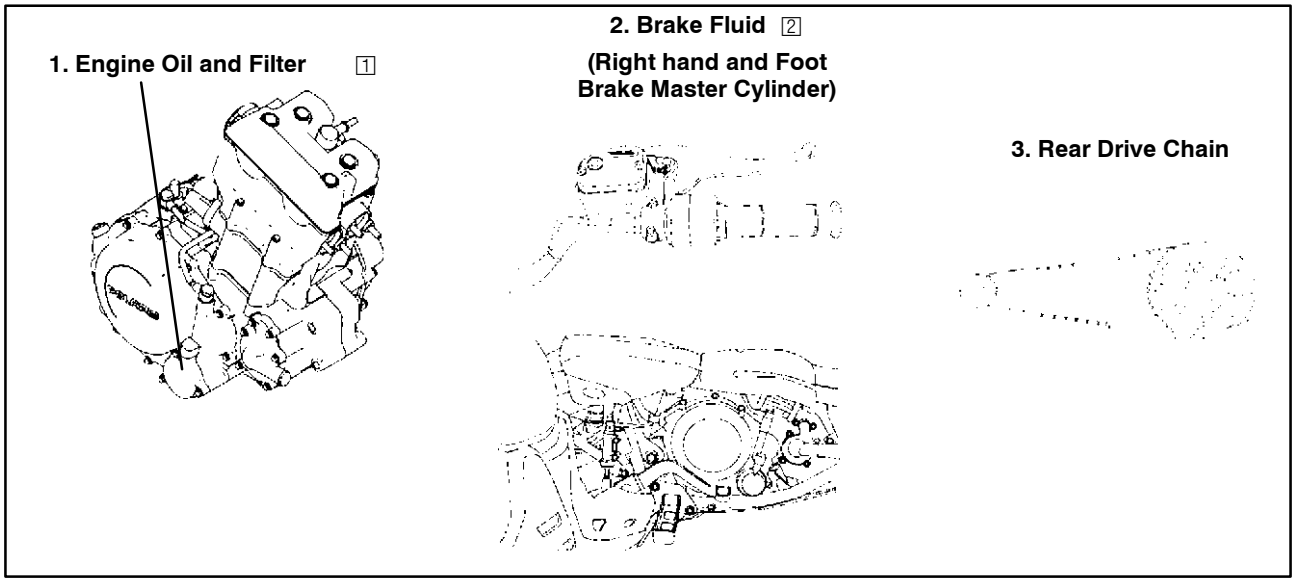
Part No.	Description
	Engine Lubricant
2874414	Engine Oil (Quart) PS 4 Synthetic (4-Cycle)
2874415	Engine Oil (Gallon) PS 4 Synthetic (4-Cycle)
	Grease / Specialized Lubricants
2871322	Premium All Season Grease (3 oz. cartridge)
2871423	Premium All Season Grease (14 oz. cartridge)
2871460	Starter Drive Grease
2871312	Grease Gun Kit
2871329	Dielectric Grease
2872073	Chain Lube (Aerosol)
	Coolant
2871323	60/40 Coolant (Gallon)
2871534	60/40 Coolant (Quart)
	Additives / Sealants / Thread Locking Agents / Misc.
2870791	Fogging Oil (12 oz. Aerosol)
2871326	Premium Carbon Clean (12 oz.)
2870652	Fuel Stabilizer (16 oz.)
2870585	Loctite™ Primer N, Aerosol, 25 g
2870990	DOT3 Brake Fluid
2871956	Loctite™ Thread Sealant 565 (50 ml.)
2871949	Loctite™ Threadlock 242 (50 ml.)
2871950	Loctite™ Threadlock 242 (6 ml.)
2871951	Loctite™ Threadlock 262 (50 ml.)
2871952	Loctite™ Threadlock 262 (6 ml.)
2871953	Loctite™ Threadlock 271 (6 ml.)
2871954	Loctite™ Threadlock 271 (36 ml.)
2870584	Loctite™ RC 680-Retaining Compound (10 ml.)
2870587	Loctite™ 518 Gasket Eliminator / Flange Sealant (50 ml.)
2872113	Disk Brake Quiet (12 oz.)
2872113	Disc Brake Quiet, Aerosol, (9 oz.)
2871957	Black RTV Silicone Sealer (3 oz. tube)
2871958	Black RTV Silicone Sealer (11 oz. cartridge)
8560054	Marine Grade Silicone Sealer (14 oz. cartridge)
2871557	Crankcase Sealant, 3-Bond 1215
2872893	Engine Degreaser

SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION	CHAPTER TOOL USED IN
8712100 or 8712500	Tachometer	2,7
2200634	Valve Seat Reconditioning Kit	3
PU-45257	Valve Spring Compressor	3
PA-46075	Flywheel Puller	3
PA-46087	Crankcase Separator	3
2870390	Piston Support Block	3
2872105	Water Pump Mechanical Seal Puller	3
PA-45958	Cam Chain Tensioner Assembly Tool	3
PA-46076	MAG End Crankshaft Nut Remover/Installer	3
PA-46077	MAG End Crankshaft Installer	3
2871283	Crankshaft/Water Pump Seal Install Kit	3
5131135	Water Pump Install Kit	3
PA-46502	Valve Spring Compressor	3
2870975	Mity Vac™ Pressure Test Tool	3, 4
2872314	Carburetor Float Adjustment Tool	4
2870623	Shock Absorber Spring Compression Tool	5
7052069	Charging Needle	5
2200421	Gas Shock Recharging Kit	5
2871352	Shock Rod Holding Tool	5
2871351	Fox™ Shock IFP Depth Tool	5
2870386	Piston Pin Puller	6
PV-43568	Fluke™ 77 Digital Multimeter	7
2870630	Timing Light	7

*Special Tools Can be ordered through a Polaris Dealer or SPX Corporation (1-800-328-6657).

LUBRICATION



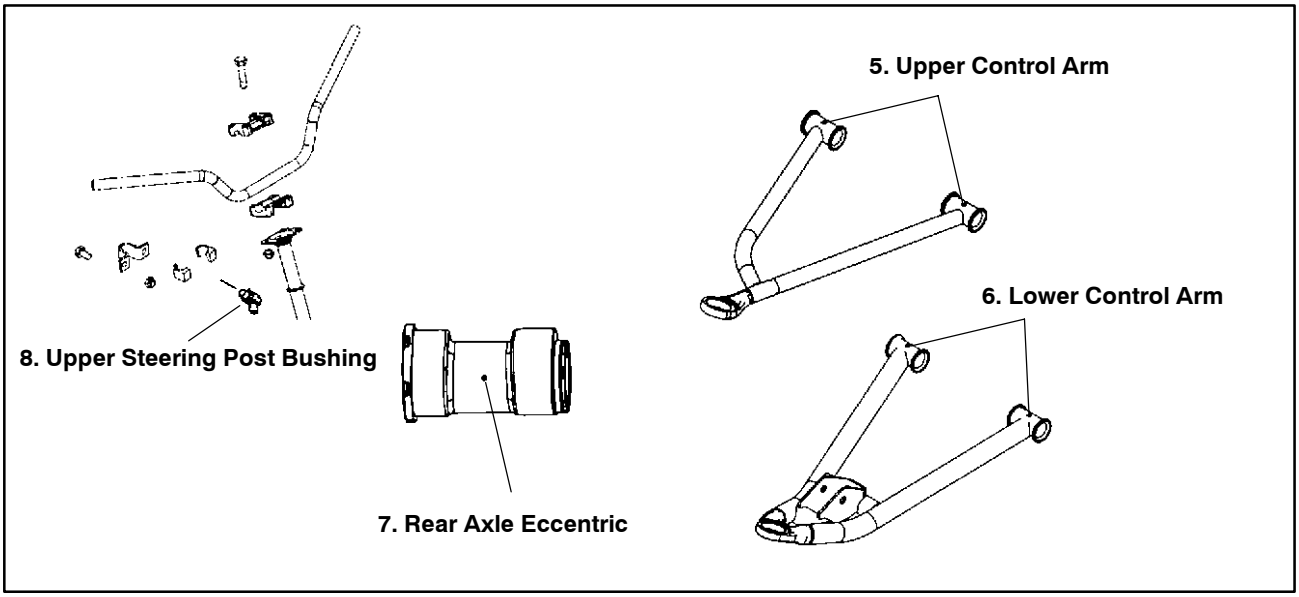
Ill. #	Item	Lube Rec.	Method	Frequency*
1.	Engine Oil / Transmission	Polaris PS-4 Synthetic	Check dipstick and add to proper level.	Perform break-in oil/filter change at one hour; change oil every 10hrs/100mi.[1]
2.	Brake Fluid	Polaris Dot 3 Brake Fluid	Fill master cylinder reservoir to indicated level inside reservoir. See Ch. 6.	As required. Change fluid every 2 years or 200 hours.[2]
3	Drive Chain	Polaris Chain Lube	Apply to chain link plates and rollers.	As required*

* More often under severe use, such as operation in mud, water, sand or under severe loads.

[1] Every 10 hours of operation (refer to Maintenance Schedule for additional information) Change more often in extremely dirty conditions (continuous operation in water, mud or sand), continuous hot, cold, or short trip cold weather operation. **NOTE:** Excessive clutch plate residue will accelerate oil change intervals

[2] Every 24 months or 200 hours of operation (refer to Maintenance Schedule for additional information) More often under severe conditions (continuous operation in water, mud or sand)

LUBRICATION, CONT.



Ill. #	Item	Lube Rec.	Method	Frequency*
5.	Upper Control Arms	Polaris All Season Grease [3]	Locate fittings and grease (also grease after washing ATV)	Every 3 months [1]
6.	Lower Control Arms	Polaris All Season Grease [3]	Locate fittings and grease (also grease after washing ATV)	Every 3 months [1]
7.	Rear Axle Eccentric	Polaris All Season Grease [3]	Locate and grease (also grease after washing ATV)	Every 3 months [1]
8.	Upper Steering Post Bushing	Polaris All Season Grease [3]	Locate fittings and grease (also grease after washing ATV)	Semi-annually [2]

* More often under severe use, such as operation in water or under severe loads.

[1] Every 3 months or 50 hours of operation (refer to Maintenance Schedule for additional information)
More often under severe conditions (continuous operation in water, mud or sand)

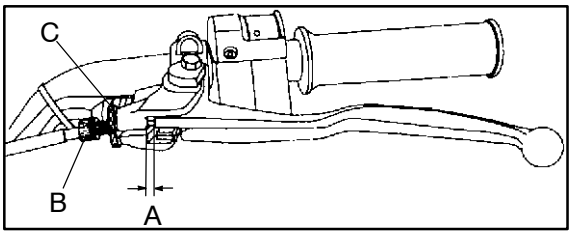
[2] Every 6 months or 50 hours of operation (refer to Maintenance Schedule for additional information)
More often under severe conditions (continuous operation in water, mud or sand)

[3] Use grease conforming to NLGI No. 2, such as Polaris Premium All Season Grease.

CLUTCH ADJUSTMENT

Clutch Lever Freeplay

1. Measure clutch lever freeplay between the perch and the lever (A). This distance should be 1/8″ - 3/16″ (3.1 mm - 4.7 mm).



2. If adjustment is required, slide the clutch perch pivot boot down the clutch cable to access the clutch adjustment screw (B) and lock ring (C).
3. Loosen the lock ring and turn the screw in (clockwise) to increase lever travel. Turn the screw out (counterclockwise) to decrease lever travel. Tighten the lock ring.
4. Squeeze the lever fully and release. Slightly squeeze the lever again until a slight resistance is felt. Measure the freeplay again. If necessary, repeat the adjustment procedure until proper freeplay is attained.
5. Replace the clutch perch pivot boot over the screw and lock ring.

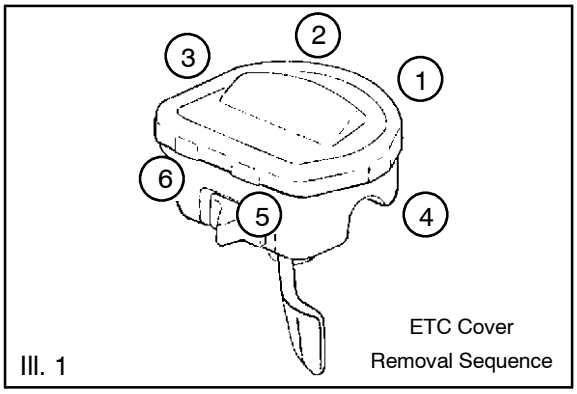
THROTTLE INSPECTION

Check for smooth throttle opening and closing in all handlebar positions. Throttle lever operation should be smooth and lever must return freely without binding.

1. Place the gear selector in neutral.
2. Set parking brake.
3. Start the engine and let it idle.
4. Turn handlebars from full right to full left. If idle speed increases at any point in the turning range, inspect throttle cable routing and condition. Adjust cable tension as needed until lock-to-lock turning can be accomplished with no rise in engine rpm.
5. Replace the throttle cable if worn, kinked, or damaged.
6. Inspect ETC cover seal and switch cavity by removing the cover. Verify that no dirt, water or mud is present.

To remove the ETC cover:

1. Use a medium flat blade screwdriver and insert blade into the pocket of the cover starting on the #1 position.
2. Twist screwdriver slightly while lifting on the cover to release snap.
3. Repeat procedure at the other five locations as shown.
   NOTE: Do not attempt to remove cover until all latch points are released.



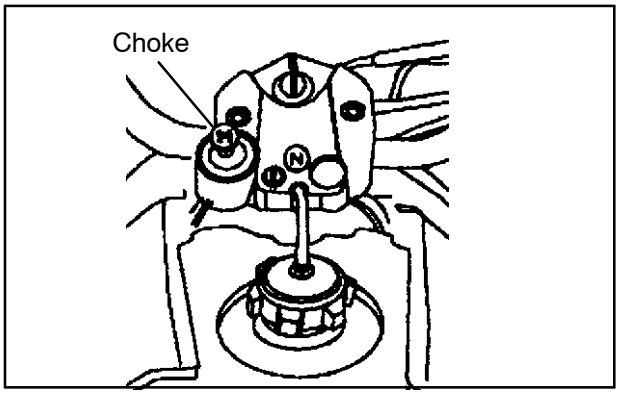
Ill. 1 ETC Cover Removal Sequence

CHOKE (ENRICHER) ADJUSTMENT

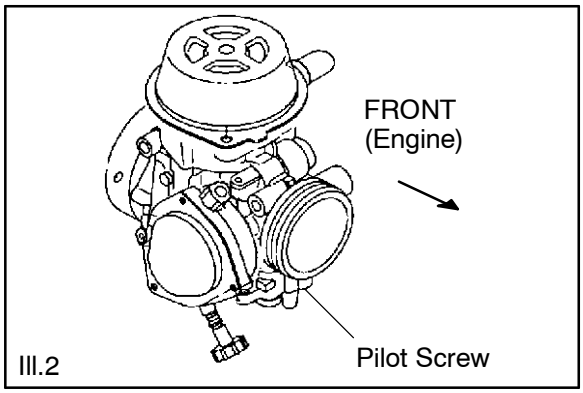
If the choke knob does not stay out when pulled, adjust the choke tension by tightening (clockwise) the jam nut under the rubber boot between the choke knob and nut. Firmly grasp the rubber boot and tighten until the choke slides freely but stays out when pulled.

Verify free play of 1/16–3/16” (1.6–4.76 mm) and smooth operation of choke cable.

If smooth choke operation is not obtainable, inspect choke cable for kinks or sharp bends in routing.



CARBURETOR PILOT SCREW ADJUSTMENT



Ill.2

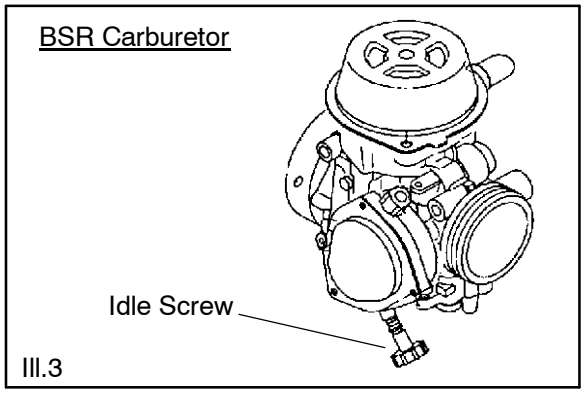
NOTE: Pilot screw is covered by a welsh plug. Plug removal will be required to perform these procedures.

1. Start engine and warm it up to operating temperature (about 10 minutes).
2. Turn pilot screw in (clockwise) until *lightly* seated. Turn screw out the specified number of turns. NOTE: Do not tighten the pilot screw forcefully against the seat or the screw and/or seat will be permanently damaged. (Ill. 2)

Pilot Screw Adjustment
Refer to Specifications in Chapter 1

3. Connect an accurate tachometer that will read in increments of + or – 50 RPM such as the PET 2100DX (**PN 8712100DX**) or the PET 2500 (**PN 8712500**).
4. Set idle speed to 1600 RPM. Always check throttle cable freeplay after adjusting idle speed and adjust if necessary.
5. Slowly turn mixture screw clockwise using the pilot screw wrench until engine begins to miss.
6. Slowly turn mixture screw counterclockwise until idle speed increases to maximum RPM. Continue turning counterclockwise until idle RPM begins to drop.
7. Center the pilot screw between the points in Step 5 and 6.
8. Re adjust idle speed to specification.

IDLE SPEED ADJUSTMENT



Ill.3

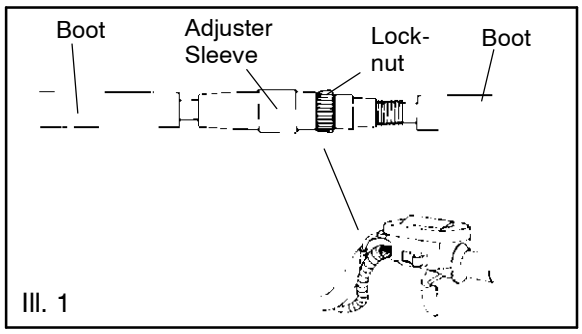
1. Start engine and warm it up thoroughly.
2. Adjust idle speed by turning the idle adjustment screw in (clockwise) to increase or out (counterclockwise) to decrease RPM. (Ill.3)

NOTE: Adjusting the idle speed affects throttle cable freeplay and electronic throttle control (ETC) adjustment. Always check throttle cable freeplay after adjusting idle speed and adjust if necessary.

Idle Speed:
1600 +/– 50 RPM

THROTTLE CABLE / ELECTRONIC THROTTLE CONTROL (ETC SWITCH) ADJUSTMENT

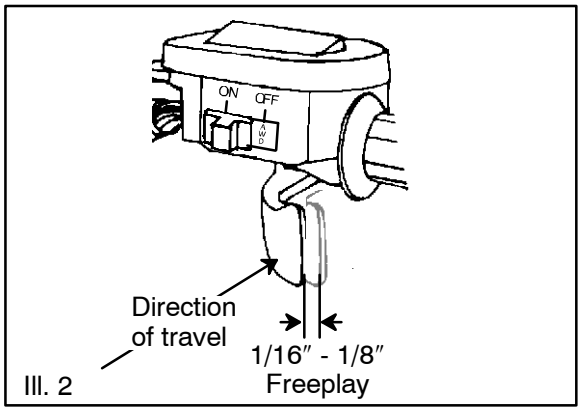
1. Slide boot off throttle cable adjuster and jam nut.
2. Place shift selector in neutral and set parking brake.
3. Start engine and set idle to 1600 RPM.



Ill. 1

NOTE: Be sure the engine is at operating temperature. See Idle Speed Adjustment.

4. Loosen lock nut on in-line cable adjuster (Ill. 1).
5. Turn adjuster until 1/16″ to 1/8″ freeplay is achieved at thumb lever. (Ill. 2). After making adjustments, quickly actuate the thumb lever several times and reverify freeplay.



Ill. 2

6. Tighten lock nut securely and slide boot completely in place to ensure a water-tight seal.
7. Turn handlebars from left to right through the entire turning range. If idle speed increases, check for proper cable routing. If cable is routed properly and in good condition, repeat adjustment procedure.

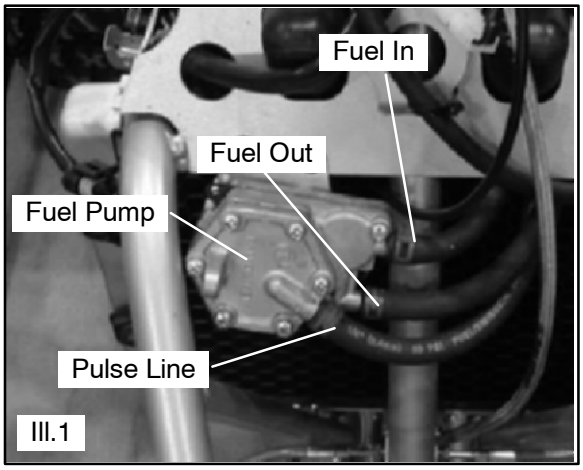
FUEL SYSTEM

⚠ WARNING

Gasoline is extremely flammable and explosive under certain conditions.

- Always stop the engine and refuel outdoors or in a well ventilated area.
- Do not smoke or allow open flames or sparks in or near the area where refueling is performed or where gasoline is stored.
- Do not overfill the tank. Do not fill the tank neck.
- If you get gasoline in your eyes or if you swallow gasoline, seek medical attention immediately.
- If you spill gasoline on your skin or clothing, immediately wash it off with soap and water and change clothing.
- Never start the engine or let it run in an enclosed area. Engine exhaust fumes are poisonous and can result loss of consciousness or death in a short time.
- Never drain the float bowl when the engine is hot. Severe burns may result.

FUEL LINES



Ill.1

1. Check fuel lines for signs of wear, deterioration, damage or leakage. Replace if necessary.
2. Be sure fuel lines are routed properly and secured with cable ties. CAUTION: Make sure lines are not kinked or pinched.
3. Replace all fuel lines every two years.

VENT LINES

Check engine, fuel tank, oil tank and carburetor vent lines for signs of wear, deterioration, damage or leakage. Replace every two years.

Be sure vent lines are routed properly and secured with cable ties. **CAUTION:** Make sure lines are not kinked or pinched.

FUEL VALVE

The Predator fuel system strains the fuel through screens located in the fuel valve. There is no fuel filter to service. To service the fuel valve:

1. Shut off fuel supply at fuel valve. Remove line clamps and fuel lines from the tank.
2. Remove the tank and drain remainder of fuel into a appropriate container.
3. Remove fuel valve by loosening the screws holding the valve to the tank.
4. Inspect the valve for damage or debris. Replace the valve if problems are found.

5. Reverse the procedures to install the fuel valve.
6. Start engine and inspect for leaks.

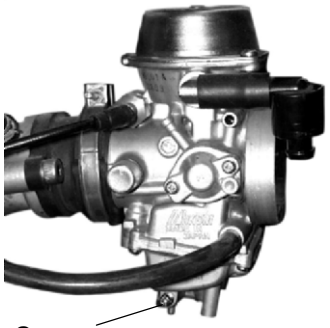
CARBURETOR DRAINING

The carburetor float bowl should be drained periodically to remove moisture or sediment from the bowl, or before extended periods of storage.

NOTE: The bowl drain screw is located on the bottom left side of the float bowl.

1. Turn fuel valve to the off position.
2. Place a clean container beneath the bowl drain spigot or bowl drain hose.
3. Turn drain screw out two turns and allow fuel in the float bowl and fuel line to drain completely.
4. Inspect the drained fuel for water or sediment.
5. Tighten drain screw.
6. Turn fuel valve to “ON”.
7. Start machine and check for leaks.

NOTE: All tubes attached to the carburetor must be check for pinching or blockage, as this will effect engine performance.



Ill. 1

COMPRESSION TEST

NOTE: This engine has built-in decompression components. Compression readings will vary in proportion to cranking speed during the test. Average compression (measured) is about **85-90 psi @ 400 RPM** during a compression test.

A smooth idle generally indicates good compression. Low engine compression is rarely a factor in running condition problems above idle speed. Abnormally high compression can be caused by carbon deposits in the combustion chamber or worn, damaged exhaust cam lobes. Inspect camshaft and combustion chamber if compression is abnormally high.

A cylinder leakdown test is the best indication of engine condition. Follow manufacturer’s instructions to perform a cylinder leakage test. (Never use high pressure leakage testers, as crankshaft seals may dislodge and leak).

Cylinder Compression w/ decompression

Standard: 85-90 PSI @ 400 RPM

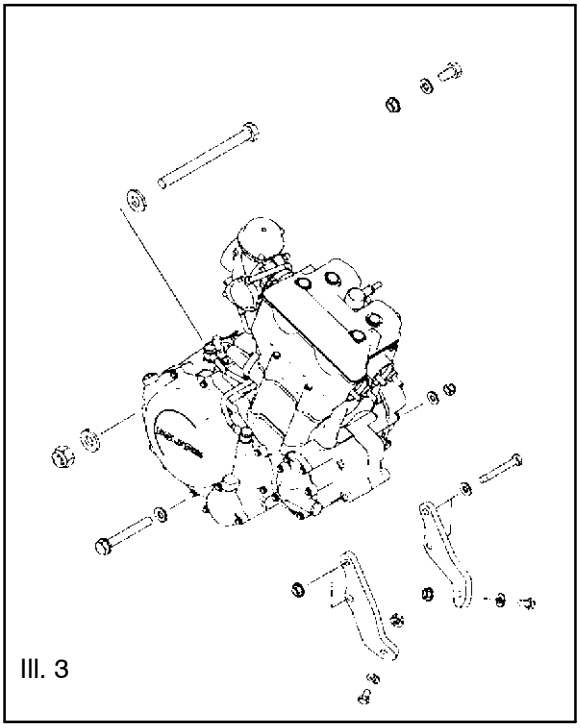
Cylinder Leakdown

Service Limit 10 %
(Inspect for cause if leakage exceeds 10%)

ENGINE MOUNTS

Inspect engine mounts and frame for cracks or damage. (Ill.3)

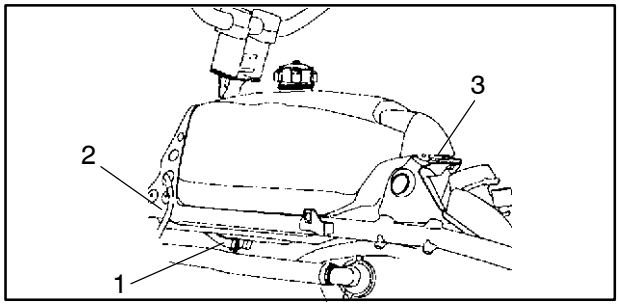
Check engine fasteners and ensure they are tight.


Ill. 3

SPARK PLUG INSPECTION

Spark Plug Removal and Replacement

1. Turn the fuel valve to OFF.
2. Remove the front cab.
3. Move the fuel valve hose clamp (1) forward and gently remove the hose from the fuel valve fitting on the gas tank.



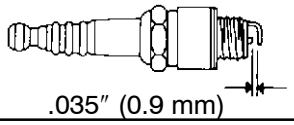
4. Remove the vent hose (2) from the instrument panel, taking note of the hose routing for reinstallation.
5. Remove the tank mounting bolt (3) at the rear of the gas tank.
6. Move the tank rearward and upward over the engine. Slowly remove the tank, being careful not to catch any hoses, wires or other components. Place the tank on a stable surface or work bench to protect the valve from contamination or damage.
7. Remove spark plug high tension lead. Clean plug area so no dirt and debris can fall into engine when plug is removed.
8. Remove spark plug. and inspect electrodes for wear and carbon buildup. The insulator tip should be a light tan color, indicating good combustion. Look for a sharp outer electrode edge with no rounding or erosion.
9. If needed, clean spark plug with electrical contact cleaner or a glass bead spark plug cleaner only. **CAUTION:** Wire brushes or coated abrasives should not be used.
10. Measure gap with a wire gauge. Refer to specifications for proper spark plug type and gap. Adjust gap if necessary by bending the side electrode carefully.
11. If necessary, replace spark plug with proper type. **CAUTION:** Severe engine damage may occur if the incorrect spark plug is used.
12. Apply a small amount of anti-seize compound to the spark plug threads.
13. Install spark plug and torque to specification. Reverse steps as needed for reassembly.

Recommended Spark Plug:

NGK DCPR8E

Spark Plug Torque:
14 Ft. Lbs. (19 Nm)

Spark Plug Gap



.035″ (0.9 mm)

IGNITION TIMING

Refer to Chapter 10 for ignition timing checks.

BATTERY MAINTENANCE

⚠ WARNING

Battery electrolyte is poisonous. It contains sulfuric acid. Serious burns can result from contact with skin, eyes or clothing. Antidote:

External: Flush with water.

Internal: Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Call physician immediately.

Eyes: Flush with water for 15 minutes and get prompt medical attention.

Batteries produce explosive gases. Keep sparks, flame, cigarettes, etc. away. Ventilate when charging or using in an enclosed space. Always shield eyes when working near batteries. KEEP OUT OF REACH OF CHILDREN.

The battery is located under the left rear fender.

NOTE: All Predator ATV batteries are Maintenance-Free design and construction. Before placing the battery into service, check the battery condition and charge accordingly. Use of Conventional Lead-Acid batteries is not recommended.

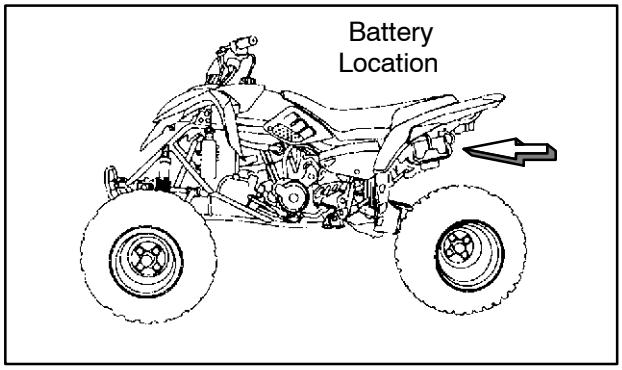
New Batteries: Batteries must be fully charged before use or battery life will be reduced by 10-30% of full potential. Charge battery for 3-5 hours at a current equivalent of 1/10 of the battery's rated amp/hour capacity (i.e. 9 amp hr x .10 = .9 amp charging). Do not use the alternator to charge a new battery.

Maintenance-Free batteries are sealed at the factory. The use of lead-calcium instead of lead-antimony allows the battery acid to be fully absorbed by the plates. Therefore, a Maintenance-Free battery case is opaque and the sealing caps are not removable, since there is no need to check electrolyte level.

NEVER attempt to add electrolyte or water to a Maintenance-Free battery. Doing so will damage the case and shorten the life of the battery. Refer to the Battery Maintenance Video (PN 9917987) for proper instruction on servicing Maintenance-Free batteries.

BATTERY INSPECTION/REMOVAL

The battery is located under the left rear fender.



To remove the battery:

1. Disconnect holder strap.
2. Disconnect battery negative (-) (black) cable first, followed by the positive (+) (red) cable.

CAUTION

To reduce the chance of sparks: Whenever removing the battery, disconnect the negative (black) cable first. When reinstalling the battery, install the negative cable last.

3. Remove the battery.
4. Clean battery cables and terminals with a stiff wire brush. Corrosion can be removed using a solution of one cup water and one tablespoon baking soda. Rinse well with clean water and dry thoroughly. Test battery for condition and charge accordingly.
5. Reinstall battery, attaching positive (+) (red) cable first and then the negative (-) (black) cable.
6. Coat terminals and bolt threads with Dielectric Grease (**PN 2871329**).
7. Reinstall battery cover and holder strap.
8. Reinstall the battery caps.
9. Charge battery at 1/10 of its amp/hour rating. Example: 1/10 of 14 amp battery = 1.4 amp
10. Reinstall the battery after testing.

BATTERY TERMINALS/BOLTS

Use Polaris corrosion resistant Dielectric Grease (**PN 2871329**) on battery bolts.

OFF SEASON STORAGE

To prevent battery damage during extended periods of non-use, the following basic battery maintenance items must be performed:

- Remove the battery from the machine and wash the case and battery tray with a mild solution of baking soda and water. Rinse with lots of fresh water after cleaning. **NOTE:** Do not get any of the baking soda into the battery or the acid will be neutralized.
- Using a wire brush or knife, remove any corrosion from the cables and terminals.
- **Never add water to a sealed maintenance free battery.**
- Charge at a rate no greater than 1/10 of the battery's amp/hr capacity until the open circuit voltage is 12.9V or greater.
- Store the battery either in the machine with the cables disconnected, or store in a cool place.

CHARGING PROCEDURE

1. Remove the battery from the ATV to prevent damage from leaking or spilled acid during charging.
2. Charge the battery with a charging output no larger than 1/10 of the battery's amp/hr rating. Charge as needed to raise the battery open circuit voltage to 12.9V or greater.

3. Install battery in vehicle with positive terminal toward the front. Coat threads of battery bolt with a corrosion resistant dielectric grease.

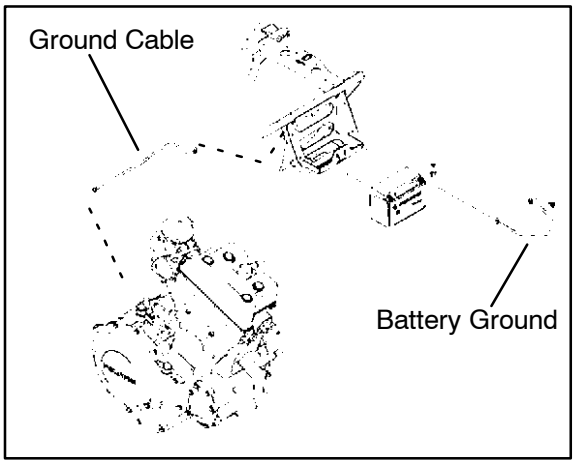
Dielectric Grease

(PN 2871329)

4. Connect the battery cables.

ENGINE-TO-FRAME GROUND

Inspect engine-to-frame ground cable connection. Be sure it is clean and tight. The engine to frame ground runs under the seat and rear cab back to the battery area.



LIQUID COOLING SYSTEM OVERVIEW

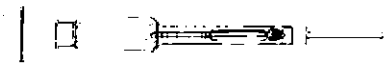
The engine coolant level is maintained by the recovery system. The recovery system components are the recovery bottle, radiator filler neck, radiator pressure cap and connecting hose.

As coolant operating temperature increases, the expanding (heated) excess coolant is forced out of the radiator past the pressure cap and into the recovery bottle. As engine coolant temperature decreases the contracting (cooled) coolant is drawn back up from the tank past the pressure cap and into the radiator.

- Some coolant level drop on new machines is normal as the system is purging itself of trapped air. Observe coolant levels often during the break-in period.
- Overheating of engine could occur if air is not fully purged from system.
- Polaris Premium 60/40 anti-freeze is premixed and ready to use. Do not dilute with water.

COOLANT STRENGTH / TYPE

Test the strength of the coolant using an antifreeze hydrometer.



Antifreeze Hydrometer

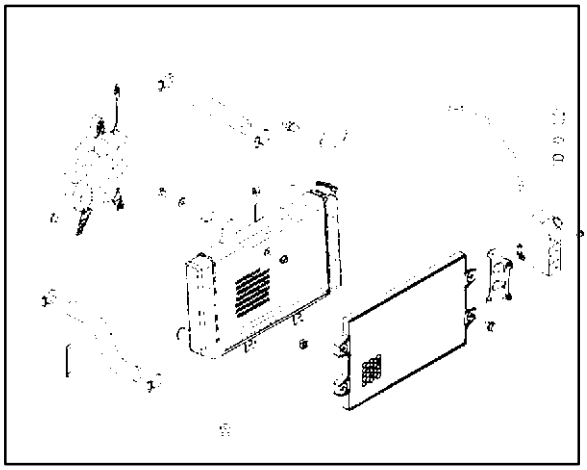
- A 50/50 or 60/40 mixture of antifreeze and distilled water will provide the optimum cooling, corrosion protection, and antifreeze protection.
- Do not use tap water. Tap water contains minerals and impurities which build up in the system. Do not add straight antifreeze or straight water to the system. Straight water or antifreeze may cause the system to freeze, corrode, or overheat.

Polaris 60/40 Anti-Freeze / Coolant

(PN 2871323)

COOLING SYSTEM HOSES

Inspect all hoses for cracks, deterioration, abrasion or leaks. Replace if necessary.



1. Check tightness of all hose clamps.
2. Do not over-tighten hose clamps at radiator or radiator fitting may distort, causing a restriction or leak. Radiator hose clamp torque is 36 in. lbs. (4 Nm).

RADIATOR

1. Check radiator external air flow passages for restrictions or damage.
2. Carefully straighten any bent radiator fins.
3. Remove any obstructions with compressed air or low pressure water.

RECOVERY COOLANT LEVEL INSPECTION

⚠ WARNING

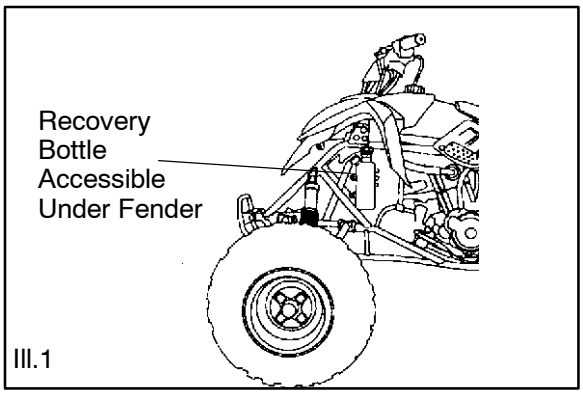
Never remove the radiator pressure cap when the engine is warm or hot. Escaping steam and fluid can cause severe burns. The engine must be allowed to cool before removing the pressure cap.

The recovery bottle, located on the left side of the machine, must be maintained between the minimum and maximum levels indicated. (Ill.1)

With the engine at operating temperature, the coolant level should be between the upper and lower marks on the coolant reservoir. If it is not:

1. Remove reservoir cap. Verify the inner splash cap vent hole is clear and open.
2. Fill reservoir to upper mark with Polaris Premium 60/40 Anti Freeze / Coolant (**PN 2871323**) or a mixture of antifreeze and distilled water as required for freeze protection in your area.
3. Reinstall cap.

NOTE: If overheating is evident, allow system to cool completely and check coolant level in the radiator. Inspect for signs of trapped air in system.



Ill.1

RADIATOR COOLANT LEVEL INSPECTION

⚠ WARNING

Never remove the radiator pressure cap when the engine is warm or hot. Escaping steam and fluid can cause severe burns. The engine must be allowed to cool before removing the pressure cap.

NOTE: This procedure is only required if the cooling system has been drained for maintenance and/or repair. However, if the recovery bottle has run dry, or if overheating is evident, the level in the radiator should be inspected via the radiator cap first and coolant added if necessary.

NOTE: Use of a non-standard pressure cap will not allow the recovery system to function properly.

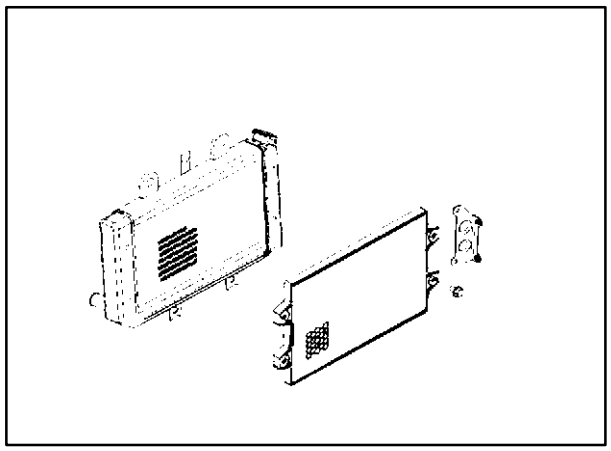
1. Remove the radiator cap and inspect. Add coolant as required up to the top of the filler neck.
2. Replace the cap. Start and idle the engine until it reaches operating temperature. Stop engine and let cool.
3. After cooling, re-verify that coolant in radiator is at the top of the filler neck and that coolant is being drawn through the recovery system.

COOLING SYSTEM PRESSURE TEST

See Chapter 3 for testing procedures.

RADIATOR SCREEN REMOVAL

1. Remove the 4 screws retaining the radiator screen for access to the radiator fins when cleaning.



AIR FILTER AND PRE-FILTER SERVICE

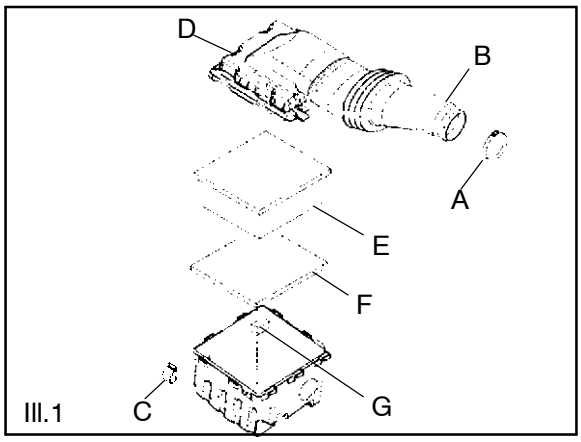
It is recommended that the air filter and pre-filter be inspected frequently. When riding in extremely dusty conditions, replacement is required more often.

The pre filter should be cleaned before each ride using the following procedure:

1. Unlatch and remove the seat.
2. Loosen the intake duct clamp (A) on the carburetor and pull the duct (B) off the carburetor.
3. Remove clips (C) from air box cover and remove cover (D). Inspect the cover. It should adhere tightly and seal all the way around.
4. Remove the air filter (E). Inspect and replace if necessary. If the filter has been soaked with fuel or oil it must be replaced.

Cleaning:

5. Remove the pre-filter (F) and the crankcase breather filter (G). Clean with hot, soapy water. Allow to dry thoroughly.
6. Inspect pre filter for tears or damage.
7. Inspect the intake and air box for cracks, deterioration, abrasion, or leaks.



Ill.1

Installation:

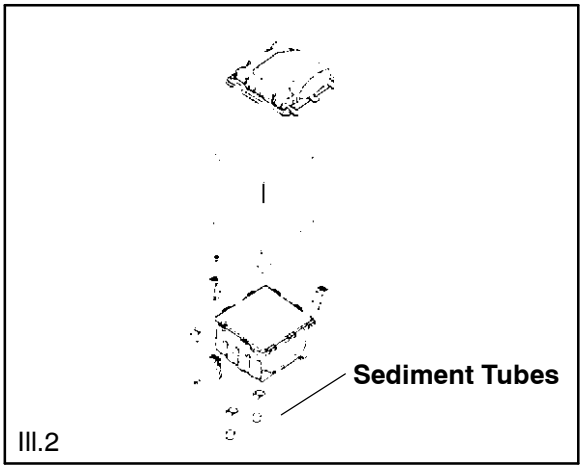
8. Reinstall crankcase breather filter, pre-filter and air filter into air box. Place intake assembly into position and reinstall clips.
9. Reinstall the intake duct to the carburetor and tighten the clamp sufficiently.

NOTE: Apply a small amount of general purpose grease to the sealing edges of the filter before reinstalling.

AIR BOX SEDIMENT TUBES

Periodically check the air box drain tube located toward the rear of the machine. Drain whenever deposits are visible in the clear tube.

1. Remove drain plug from end of sediment tube.
2. Drain tube.
3. Reinstall drain plug.



Ill.2

NOTE: The sediment tube will require more frequent service if the vehicle is operated in wet conditions or at high throttle openings for extended periods.

CRANKCASE BREATHER FILTER INSPECTION

Predator ATV engines are equipped with a crankcase breather filter in the air box. The filter is similar in appearance to a small foam block, and is visible on the left side (Location G, Ill 1).

The air breather filter should be inspected or replaced whenever the air filter is inspected.

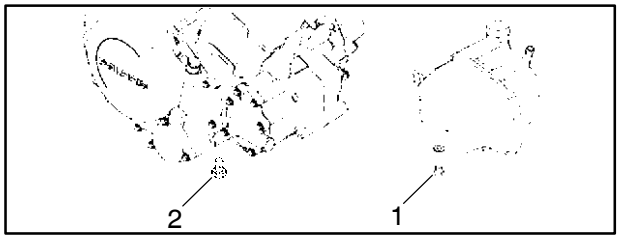
OIL AND FILTER SERVICE

NOTICE: Polaris PS-4 Engine Oil is recommended for use in the Predator. PS-4 was specifically designed for the Predator's engine and clutching system. Other oils do not contain the needed additives to prolong engine life and provide proper lubrication to the Predator clutch and transmission components.

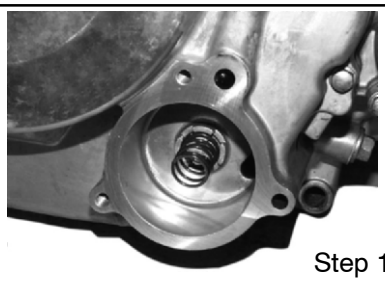
1. Place the vehicle on a level surface.
2. Clean the area around the oil tank (1) and crankcase (2) drain plugs with clean shop towels.

CAUTION
Hot oil can cause serious burns to skin. Do not allow hot oil to contact skin.

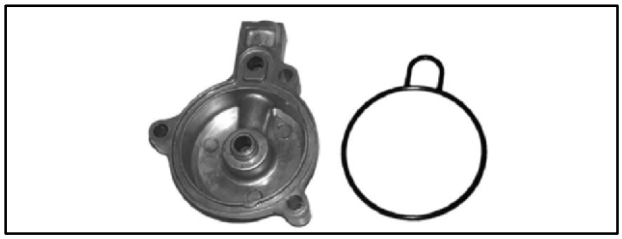
3. Run the engine for two to three minutes until warm, then stop the engine.
4. Place a drain pan beneath the oil tank and remove the drain plugs.



5. Allow the oil to drain completely.
6. Replace the sealing washer and reinstall the plug. Torque to 14 ft. lbs. (19 Nm). **NOTE:** The sealing surfaces on drain plugs, oil tank and crankcase should be clean and free of burrs, nicks or scratches.
7. Place a drain pan beneath the crankcase and remove the drain plug.
8. Allow the oil to drain completely.
9. Replace the sealing washer and reinstall the plug. Torque to 14 ft. lbs. (19 Nm).
10. Place shop towels beneath the oil filter.
11. Remove the three cover bolts and remove the cover.
12. Pull out the oil filter. **NOTE:** A spring located behind the filter may pop out as the filter is removed. The spring must be reinstalled with the new filter.


Step 12.

13. Using a clean dry cloth, clean the filter sealing surfaces.
14. Replace the o-ring in the cover.



15. Lubricate the gasket on the new filter with a film of fresh engine oil.
16. Reinstall the spring and install the new filter with the open end facing outward.
17. Install the cover and torque the bolts to 72-78 in. lbs. (8-9 Nm). **NOTE:** The long bolt must be placed in the forward hole.
18. Remove the dipstick and fill the oil tank with 2.25 quarts (1.9 l) of Polaris PS-4 Engine Oil (**PN 2874414**).
19. Place gear selector in neutral and set parking brake.
20. Start the engine and let it idle for one to two minutes. Stop the engine and inspect for leaks.
21. Re-check the oil level on the dipstick and add oil as necessary to bring the level to the upper mark on the dipstick.
22. Dispose of used filter and oil properly.

STEERING

The steering components should be checked periodically for loose fasteners, worn tie rod ends, ball joints, and damage. Also check to make sure all cotter pins are in place. If cotter pins are removed, they must not be re-used. Always use new cotter pins.

Replace any worn or damaged steering components. Steering should move freely through entire range of travel without binding. Check routing of all cables, hoses, and wiring to be sure the steering mechanism is not restricted or limited. **NOTE:** Whenever steering components are replaced, check front end alignment. Use only genuine Polaris parts.

⚠ WARNING

Due to the critical nature of the procedures outlined in this chapter, Polaris recommends steering component repair and adjustment be performed by an authorized Polaris MSD-certified technician when replacing worn or damaged steering parts. Use only genuine Polaris replacement parts.

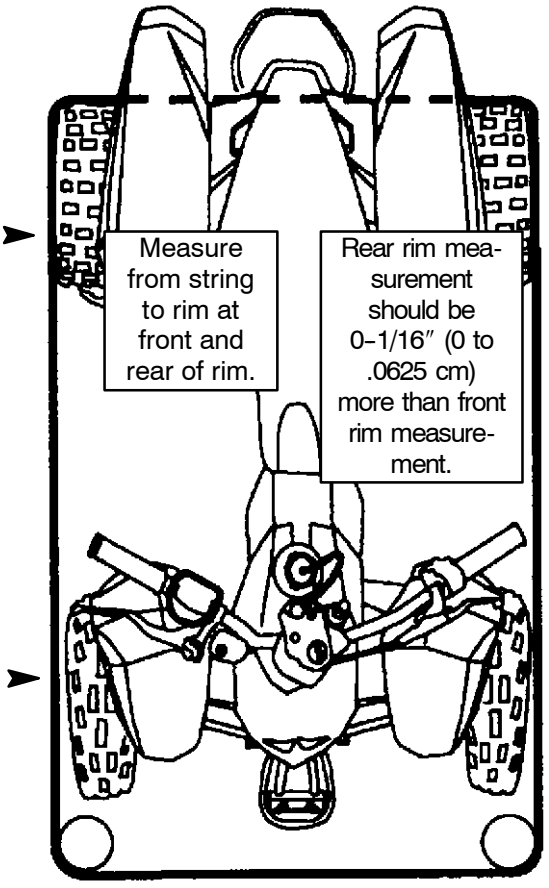
WHEEL ALIGNMENT

One of two methods can be used to measure toe alignment. The string method and the chalk method. If adjustment is required, refer to following for procedure.

METHOD 1: STRAIGHTEDGE OR STRING

Be sure to keep handlebars centered. See notes.

NOTE: String should just touch side surface of rear tire on each side of machine.

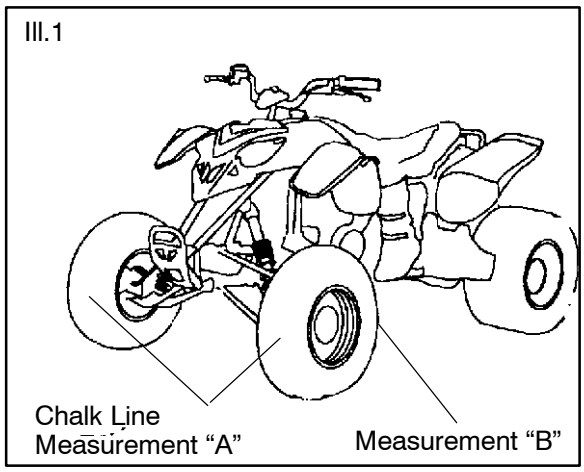


NOTE: The steering post arm “frog” can be used as an indicator of whether the handlebars are straight. The frog should be centered with equal clearance between the steering stops.

METHOD 2: CHALK

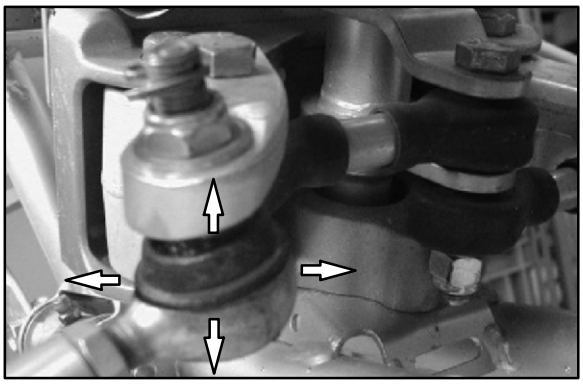
1. Place machine on a smooth level surface.
2. Set handlebars in a straight ahead position and secure handlebars in this position. **NOTE:** The steering post arm “frog” can be used as an indicator of whether the handlebars are straight. The frog should be centered with equal clearance between the steering stops.
3. Place a chalk mark on the center line of the front tires as close to the hub/axle center line as possible, or measure to a specific distance from the floor. **NOTE:** It is important that the height of both marks be equally positioned in order to get an accurate measurement.
4. Measure the distance between the marks and record the measurement. Call this measurement “A”.
5. Rotate the tires 180° by moving vehicle forward or backward. Position chalk marks even with the hub/axle centerline or the specified floor measurement.
6. Again measure the distance between the marks and record. Call this measurement “B”. Subtract measurement “B” from measurement “A”. The difference between measurements “A” and “B” is the vehicle toe alignment. The recommended vehicle toe tolerance is 0 to 1/16″ (0 to .0625 cm) toe out. This means the measurement at the front of the tire (A) is 0 to 1/16″ (0 to .0625 cm) wider than the measurement at the rear (B).

Ill.1

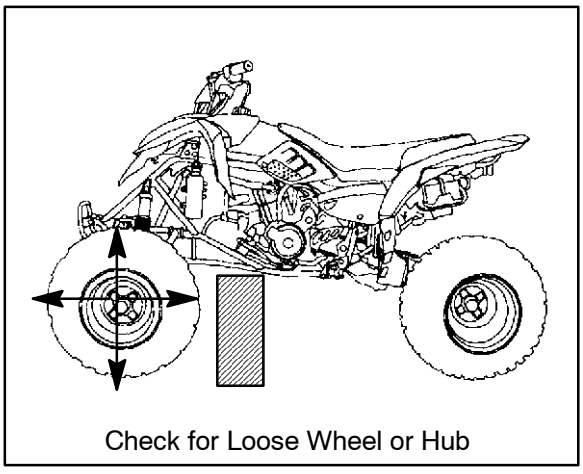


STEERING INSPECTION / TIE ROD ENDS AND HUBS /

- To check for play in the tie rod end, grasp the steering tie rod, pull in all directions feeling for movement.
- Repeat inspection for inner tie rod end on steering post.



- Elevate front end of machine so front wheels are off the ground. Check for any looseness in front hub / wheel assembly by grasping the tire firmly at top and bottom first, and then at front and rear. Try to move the wheel and hub by pushing inward and pulling outward.
- If abnormal movement is detected, inspect the hub and wheel assembly to determine the cause (possible loose wheel nuts or loose front hub components).



Check for Loose Wheel or Hub

- Refer to the Body/Suspension Chapter 5 or Final Drive Chapter for service procedures.

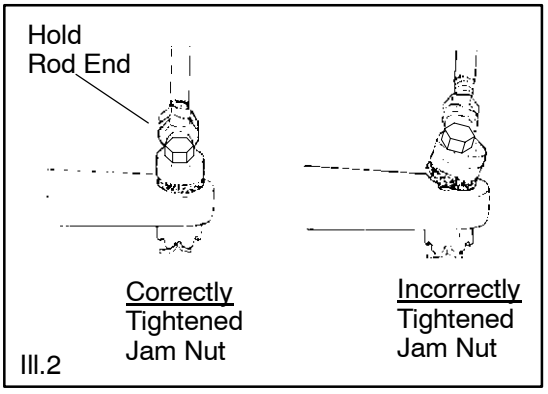
CAMBER AND CASTER

The camber and caster are non-adjustable.

TOE ALIGNMENT ADJUSTMENT

If toe alignment is incorrect, measure the distance between vehicle center and each wheel. This will tell you which tie rod needs adjusting. **NOTE:** Be sure handlebars are straight ahead before determining which tie rod(s) need adjustment.

CAUTION: During tie rod adjustment, it is very important that the following precautions be taken when tightening tie rod end jam nuts. If the rod end is positioned incorrectly it will not pivot, and may break.



Ill.2

To adjust toe alignment:

- Hold tie rod end to keep it from rotating.
- Loosen jam nuts at both end of the tie rod.
- Shorten or lengthen the tie rod until alignment is as required to achieve the proper toe setting as specified in Method 1 or Method 2.
- **IMPORTANT:** When tightening the tie rod end jam nuts, the rod ends must be held parallel to prevent rod end damage and premature wear. Damage may not be immediately apparent if done incorrectly. See illustration 2.
- After alignment is complete, torque jam nuts to 12-14 ft. lbs. (16-19 Nm).

EXHAUST PIPE

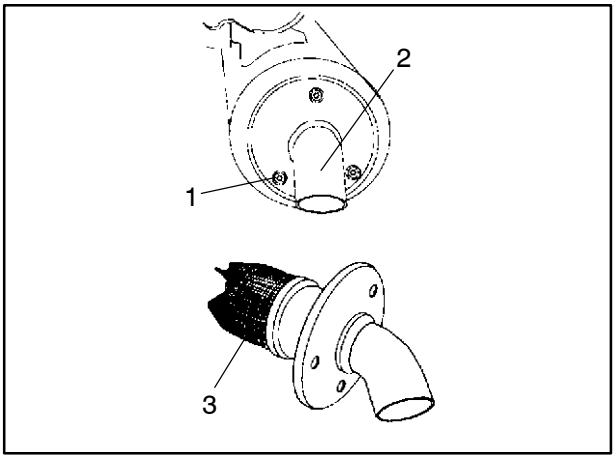
⚠ WARNING

- Do not perform clean out immediately after the engine has been run, as the exhaust system becomes very hot. Serious burns could result from contact with exhaust components.
- To reduce fire hazard, make sure that there are no combustible materials in the area when purging the spark arrestor.
- Wear eye protection.
- Do not stand behind or in front of the vehicle while purging the carbon from the spark arrestor.
- Never run the engine in an enclosed area. Exhaust contains poisonous carbon monoxide gas.
- Do not go under the machine while it is inclined. Set the hand brake and block the wheels to prevent roll back.

Failure to heed these warnings could result in serious personal injury or death.

Periodically clean the spark arrestor to remove accumulated carbon.

1. Remove the three screws (1) and remove the arrestor (2) from the end of the muffler.
2. Use a non-synthetic brush to clean the arrestor screen (3). A synthetic brush may melt if components are warm.

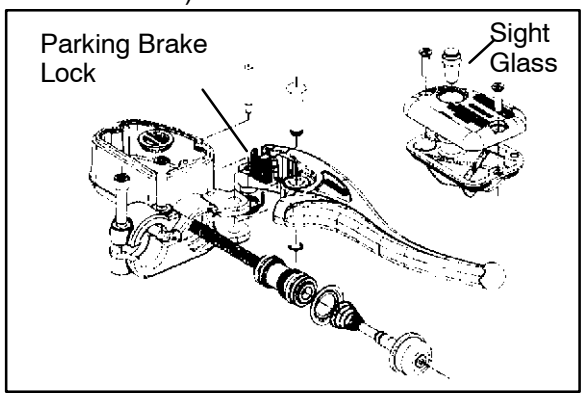


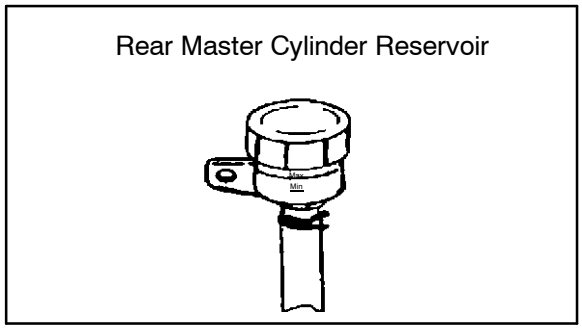
3. Inspect the screen for erosion and replace if necessary.
4. Remove and inspect the gasket. Replace if worn or damaged.
5. Reinstall the gasket and arrestor.
6. Torque screws to 50 in. lbs. (5.6 Nm).

BRAKE SYSTEM INSPECTION

The following checks are recommended to keep the brake system in good operating condition. Service life of brake system components depends on operating conditions. Inspect brakes in accordance with the maintenance schedule and before each ride.

- Keep fluid level in the master cylinder reservoir to the indicated level inside reservoir.
- Use Polaris DOT 3 Brake Fluid (**PN 2870990**).

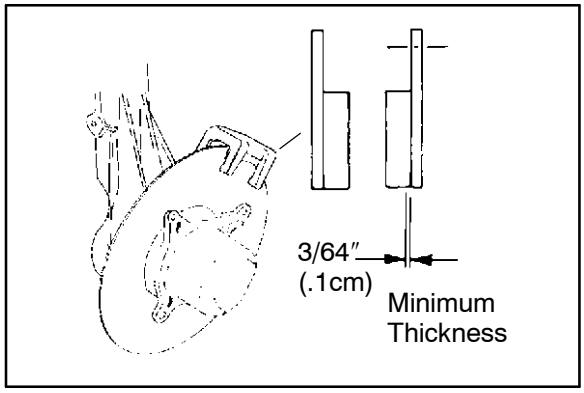




- Check brake system for fluid leaks.
- Check brake for excessive travel or spongy feel.
- Check friction pads for wear, damage or looseness.
- Check surface condition of the disc.
- Inspect thickness of brake pad friction material.

BRAKE PAD INSPECTION

Pads should be changed when the friction material is worn to 3/64″ (.1 cm), or about the thickness of a U.S. dime.

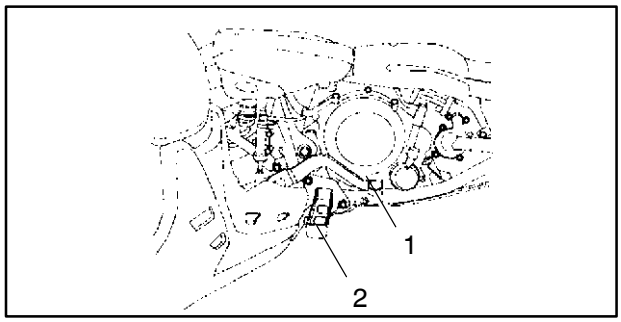


HOSE/FITTING INSPECTION

Check brake system hoses and fittings for cracks, deterioration, abrasion, and leaks. Tighten any loose fittings and replace any worn or damaged parts.

BRAKE TESTING

The foot brake should be checked for proper function.



When applied, the brake power should be sufficient enough to stop the wheels under most conditions.

If brake operation is poor, two things must be examined:

Free Play:

Free play of the brake pedal should be 1/8 - 1/4 inch (3.2 - 6.35 mm).

If free play is excessive, inspect pedal, linkage, and master cylinder for wear or damage and replace any parts as needed.

Bleeding:

If free play is correct and brake pedal travel is still excessive, air may be trapped somewhere in the system. Bleed the hydraulic auxiliary brake system in a conventional manner, following the procedure outlined in Brake Chapter 6.

SUSPENSION: SPRING PRELOAD ADJUSTMENT

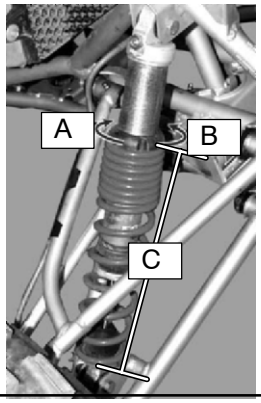
Operator weight and vehicle loading affect suspensionspringpreloadrequirements.Adjustas necessary.

Front Suspension

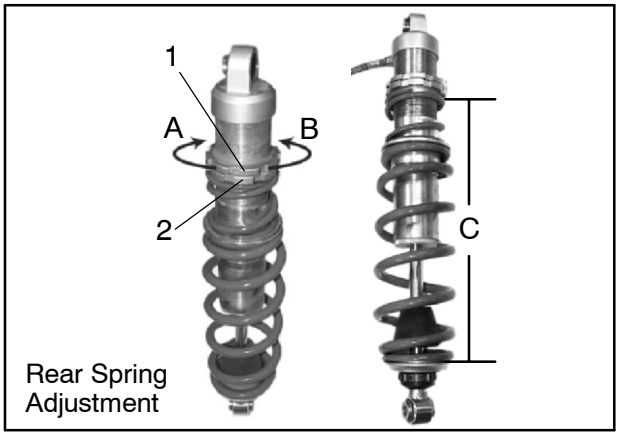
- Compress and release front suspension. Damping should be smooth throughout the range of travel.
- Check all front suspension components for wear or damage.
- Inspect front strut cartridges for leakage.

1. Raise and safely support the front of the ATV off the ground to allow the suspension to fully extend.
2. Turn the adjusting ring to the left (A) to increase preload. Turn the ring to the right (B) to decrease preload. **NOTE:** The fully extended installed spring length (C) should not exceed 11.875 inches (30 cm). Exceeding this length may cause the spring to unseat from the shock body.

FRONT	
Setting	**Spring Length**
Softest	11.875 inches
Factory	**11.5 inches**
Firmest	11.125 inches



REAR			
Setting	**Spring Length**	**Compression Damping**	**Rebound Damping**
Softest	11.875 inches	Clicker Position 1	15 clicks from closed
Factory	**11.625 inches**	**Clicker Position 4**	**10 clicks from closed**
Firmest	11.0 inches	Clicker Position 8	3 clicks from closed



Rear Spring Adjustment

DRIVE CHAIN AND SPROCKET INSPECTION

Polaris ATV drive chains are equipped with O-ring sealed permanently greased pins and rollers. The sprockets and outer rollers require periodic lubrication. Lubricate the chain with Polaris Chain Lubricant (**PN 2872073**).

Inspect the drive chain for missing or damaged O-Rings, link plates, or rollers. Do not wash the chain with a high pressure washer, gasoline or solvents; do not use a wire brush to clean the chain as damage to the O-Rings may occur. Clean chain with hot soapy water and a soft bristled nylon brush.

Never allow battery acid to contact the drive chain.

SPROCKET INSPECTION

Inspect the sprocket for worn, broken or bent teeth.

To check for wear, pull upward on the chain. Replace sprocket if chain movement exceeds 1/4″ (.6 cm).

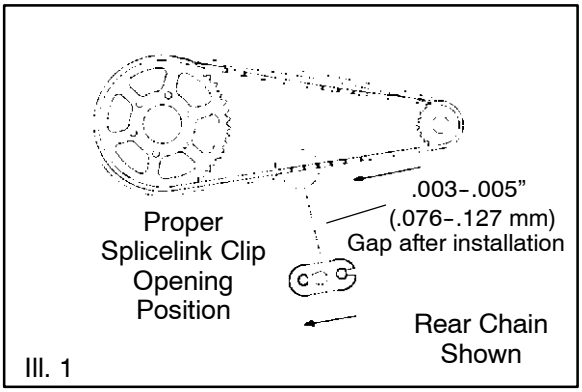
DRIVE CHAIN INSPECTION

The chain must be replaced when it reaches 3% elongation.

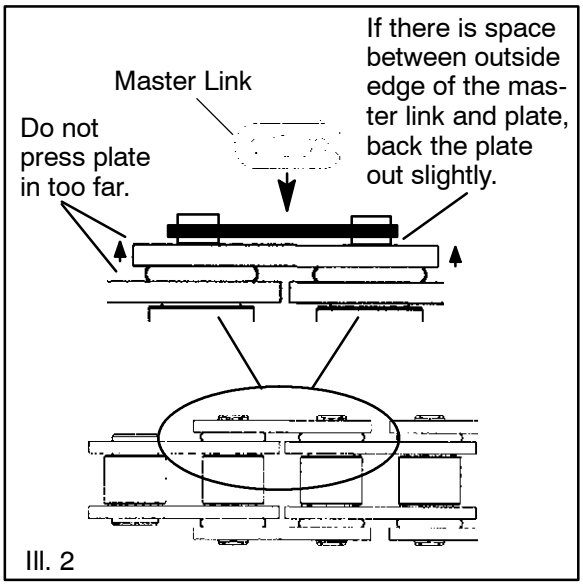
1. Stretch the chain tightly in a straight line.
2. Measure the length of twenty pitches (pins) from pin center to pin center, and compare to the specification. Replace the chain if the length exceeds the wear limit.

Drive Chain Wear Limit, 20 Pitch Length:
Std: 12.5″ (32 cm)
Wear Limit: 12.875″ (32.7 cm)

3. When replacing or reinstalling drive chain, install the closed end of the splice link clip as shown, with the closed end leading in forward operation. There should be a .003–.005” (.076–.127 mm) gap between the side plate of the chain and the splice link clip. See Illustrations 1 and 2.



Ill. 1



Ill. 2

DRIVE CHAIN ADJUSTMENT, CONCENTRIC SWINGARM

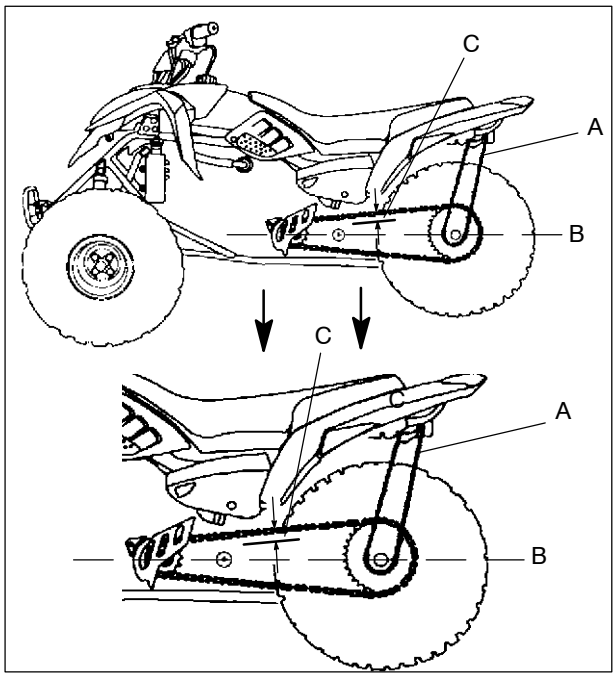
⚠ **CAUTION:** Never adjust or operate the vehicle with the rear drive chain too loose or too tight as severe damage to the transmission and drive components can result. Chain tension must be inspected with the swing arm in the position shown in the illustration so that the axle, swingarm pivot, and drive spocket are aligned horizontally (B).

Break-In: It is extremely important to maintain proper chain tension to ensure the best possible chain life. There is a chain break-in period of approximately 100 miles or two (2) tanks of fuel. During this time chain tension should be watched very closely and loads to the chain should be kept light.

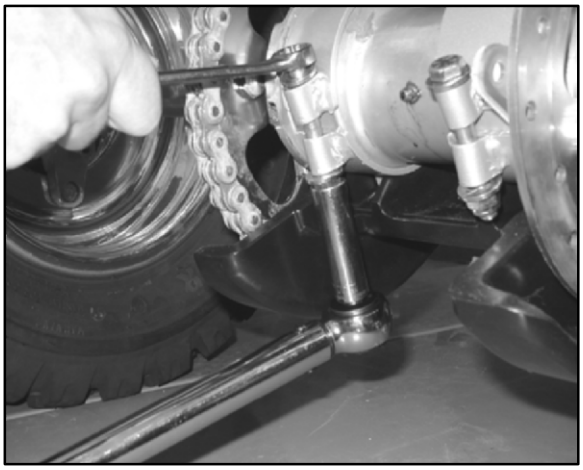
Checking Chain Tension:

Check the amount of chain slack by moving the vehicle slightly forward to gain slack at the top side of the rear chain.

1. Collapse the suspension with an adjustable (buckle type) trailer tie down strap (A). Fasten the strap around the axle and rear bumper tube.
2. Tighten the strap until a straight line (B) can be drawn from the axle to the transmission output shaft, intersecting the swing arm pivot. This establishes the tightest chain position.
3. At this point (C) the chain should have **1/4” - 3/8“ (0.6 -0.9 cm)** deflection. Use the procedure on the following page if the chain needs adjustment.

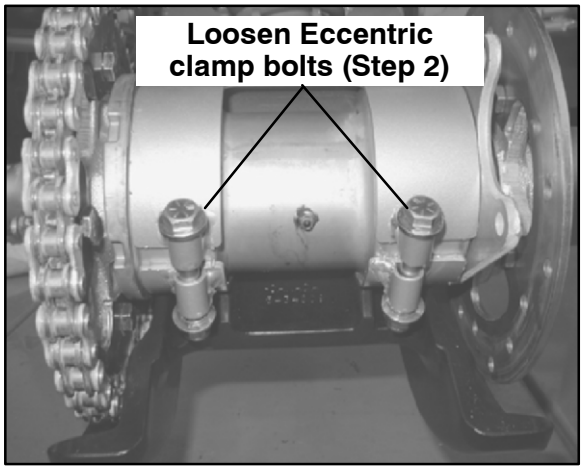


3. Roll the vehicle ahead or back to adjust chain slack to the proper dimension.
4. Tighten the eccentric locking bolts to **45 ft. lbs. (61 Nm)**.

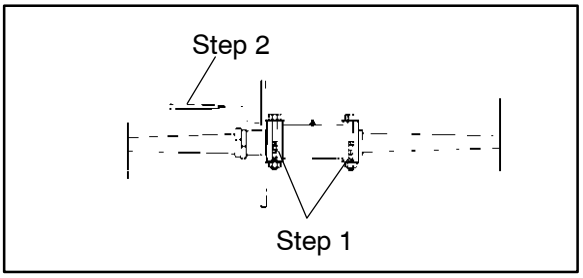


CAUTION: DO NOT OVER-TIGHTEN ECCENTRIC CLAMP BOLTS. PRE-MATURE BEARING FAILURE MAY RESULT.

ADJUSTMENT PROCEDURE - SWINGARM / REAR AXLE



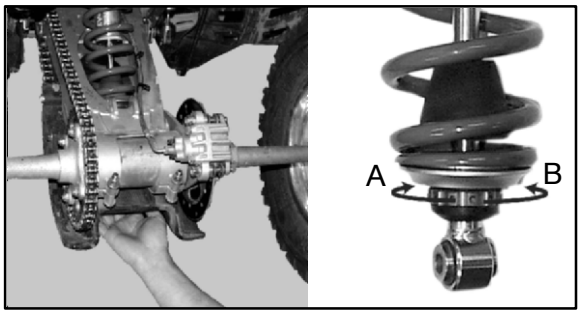
1. Loosen two eccentric locking bolts.
2. Insert a pin punch into the eccentric axle housing.



SHOCK REBOUND AND COMPRESSION DAMPING ADJUSTMENT

Rebound Damping

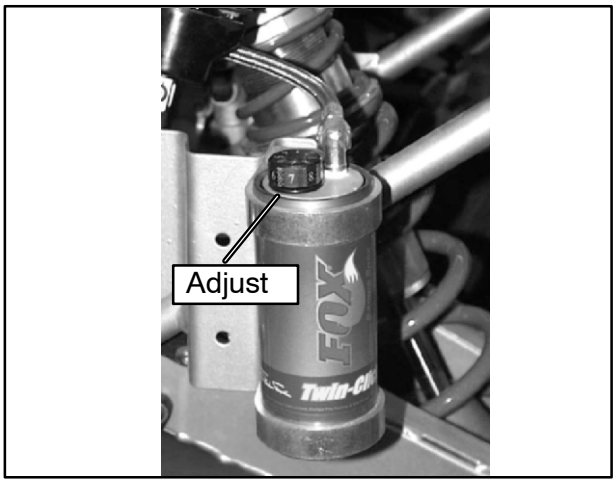
1. Locate the rebound damping clicker drum between the lower spring seat and the lower shock mount.
2. Turn the clicker to the left (A) to increase the rebound damping. Turn it to the right (B) to decrease rebound damping.
   NOTE: The clicker drum is effective up to 15 clicks from fully closed. The rebound damping is factory set at 10 clicks from fully closed.



Compression Damping

The compression damping clicker drum is located on top of the shock reservoir, under the left rear fender.

It has eight possible positions ranging from position 1 (softest) to 8 (firmest). The compression damping is factory set at position 4. To adjust, turn the clicker drum to the desired setting.



CONTROLS

Check controls for proper operation, positioning and adjustment.

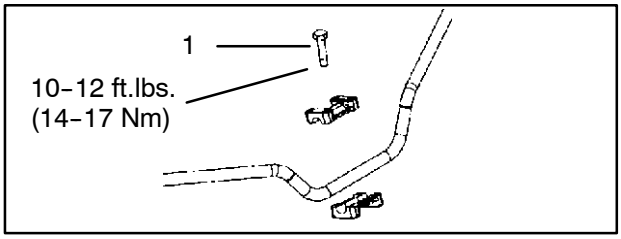
Handlebars

If desired, the handlebars can be adjusted for rider preference.

⚠WARNING

Improper adjustment of the handlebars or incorrect torquing of the adjuster block bolts can cause limited steering or loosening of the handlebars, which could result in loss of control and serious injury or death.

1. Remove the instrument panel and locate the handlebar bolts (1).



2. Loosen the four bolts and adjust the handlebar to the desired height. Be sure the handlebars do not contact the gas tank or any other part of the machine when turned fully to the left or right.
3. Torque the front two bolts to **10-12 ft. lbs. (14-17 Nm)**, then torque the rear two bolts. A gap of up to 1/8” will remain at the rear bolts.

WHEELS

Inspect all wheels for runout or damage. Check wheel nuts and ensure they are tight. Do not over tighten the wheel nuts.

WHEEL, HUB, AND SPINDLE TORQUE TABLE

Item	Specification
Front Wheel Nuts	20 Ft. Lbs. (41 Nm)
Rear Wheel Nuts	20 Ft. Lbs. (41Nm)
Front Spindle Nut	40 Ft. lbs. (55 Nm)
Rear Hub Retaining Nut	80 Ft. Lbs. (108 Nm)

WHEEL REMOVAL: FRONT OR REAR

Wheel Removal

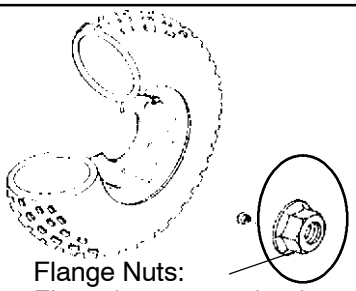
1. Stop the engine, place the transmission in gear and lock the parking brake.
2. Loosen the wheel nuts slightly.
3. Elevate the side of the vehicle by placing a suitable stand under the footrest frame.
4. Remove the wheel nuts and remove the wheel.

Wheel Installation

1. With the transmission in gear and the parking brake locked, place the wheel in the correct position on the wheel hub. Be sure the valve stem is toward the outside and rotation arrows on the tire point toward forward rotation.
2. Attach the wheel nuts and finger tighten them.
3. Lower the vehicle to the ground.
4. Securely tighten the wheel nuts to the proper torque listed in the table.

CAUTION:

Improperly installed wheels could affect vehicle handling and tire wear. On vehicles with tapered rear wheel nuts, make sure tapered end of nut goes into taper on wheel.



TIRE PRESSURE

CAUTION:

Maintain proper tire pressure. Refer to the warning tire pressure decal applied to the vehicle.

Tire Pressure Inspection (PSI - Cold)	
Front	**Rear**
5	5

TIRE INSPECTION

- Improper tire inflation may affect ATV maneuverability.
- When replacing a tire always use original equipment size and type.
- The use of non-standard size or type tires may affect ATV handling.

Tire Tread Depth

Always replace tires when tread depth is worn to 1/8″ (3 mm) or less.

⚠WARNING

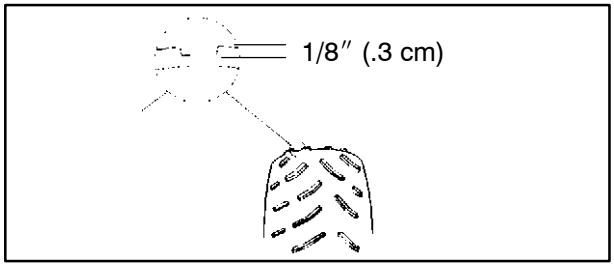
Operating your ATV with worn tires, improperly inflated tires, non-standard tires or improperly installed tires will affect vehicle handling and could cause an accident resulting in serious injury or death.

Maintain proper tire pressure as described on the ATV decal and in the owner's manual.

Always use original equipment size and type when replacing tires.

Make sure the wheels are installed properly.

Always replace tires when the tread depth measures 1/8″ (.3 cm) or less.



FRAME, NUTS, BOLTS, FASTENERS

Periodically inspect the torque of all fasteners in accordance with the maintenance schedule. Check that all cotter pins are in place. Refer to specific fastener torques listed in each chapter.

NOTES

CHAPTER 3
ENGINE

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS		
Fastener	**Thread**	**ES50PL Ft. Lbs. (Nm)**
Blind Plug (Crankcase)	1/8 PT	6.6-11.1 (9-15 Nm)
Blind Plug (Oil Filter Cover)	1/4 PT	12.5-17 (17-23 Nm)
Bearing Stop Plates	6mm	8.1-9.6 (11-13 Nm)
Camshaft Chain Tensioner Blade Bolt	8mm	10-12.2 (13.5-16.5 Nm)
Camshaft Chain Tensioner	6mm	6.6-8.1 (9-11 Nm)
Camshaft Chain Tensioner Cap	10mm	14-19 (20-25 Nm)
Camshaft Support	8mm	6.6-8.1 (9-11 Nm)
Carburetor Adaptor	8mm	11.8-14.8 (16-20 Nm)
Crankcase Cover	8mm	6.6-8.1 (9-11 Nm)
Crankshaft Nut (Primary Drive Sprocket)	18mm	59-74 (80-100 Nm)
Crankshaft Nut (Ball Bearing at Crankshaft)	32mm	66-81 (90-110 Nm)
Cylinder Base/Head Bolts	14mm 6mm	**Refer to Page 3.37** 6-8 (9-11 Nm)
Clutch Basket Nut	18mm	66-81 (90-110 Nm)
Clutch Cover	6mm	6.6-8.1 (9-11 Nm)
Drive Sprocket and Sprocket Cover	6mm	6.6-8.1 (9-11 Nm)
Flywheel – Apply engine oil to threads	14mm	111-125 (150-170 Nm)
Neutral Indicator Switch	5mm	2.2-3.7 (3-5 Nm)
Oil Delivery Pipe	12mm	11.1-15.5 (15-21 Nm)
Oil Drain Bolt (Crankcase)	14mm	14-17 (19-23 Nm)
Oil Filter Cover Housing and Oil Pump Case	6mm	6.6-8.1 (9-11 Nm)
Oil Hose Fittings	8mm	6.5-11 (9-15 Nm)
One Way Valve Plug	11mm	14.8-19.2 (20-26 Nm)
One Way Clutch Screws	6mm	9.6-11.1 (13-15 Nm)
Pulser Coil – Apply PN2871557 to threads	5mm	1.8-2.6 (2.5-3.5 Nm)
Pressure Plate Screws	6mm	6.6-8.1 (9-11 Nm)
Shift Cam	6mm	5.9-7.4 (8-10 Nm)
Shift Lever	6mm	6.6-8.1 (9-11 Nm)
Stopper (Detent) Arm –– Apply PN2871557 to threads	6mm	6.6-8.1 (9-11 Nm)
Stator Housing Cover	6mm	6.6-8.1 (9-11 Nm)
Stator Plate	5mm	4.1-5.8 (5.5-6.5 Nm)
Starter Motor	6mm	6.6-8.1 (9-11 Nm)
Spark Plug	**12mm**	**11.1-14.8 (15-20 Nm)**
Timing Cover Plug (Center)	32mm	7.4-8.8 (10-12 Nm)
Timing Cover Plug (Timing window)	14mm	2-4 (3-5 Nm)
Thermo Cover	6mm	5.2-6.6 (7-9 Nm)
Thermo Switch	3/8 NPT	23.6-28 (32-38 Nm)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS		
Fastener	**Thread**	**ES50PL Ft. Lbs. (Nm)**
Valve Cover	6mm	6.6-8.1 (9-11 Nm)
Water Pump Impeller	6mm	6.6-8.1 (9-11 Nm)
Water Pump Housing Cover	6mm	6.6-8.1 (9-11 Nm)

ES50PL ENGINE SERVICE DATA

Cylinder Head / Valve				**ES50PL**
Camshaft	Cam lobe height	In	Std	1.667-1.671″ (42.35-42.45 mm)
			Limit	1.655″ (42.05 mm)
		Ex	Std	1.667-1.671″ (42.35-42.45 mm)
			Limit	1.655″ (42.05 mm)
	Camshaft journal OD		Mag	.9821-.9828″ (24.946-24.963 mm)
			PTO	.8652-.8655″ (21.976-21.985 mm)
	Camshaft journal bore ID		Mag	.9842-.9851″ (25.000-25.021 mm)
			PTO	.8657-.8661″ (21.990-22.000 mm)
	Camshaft Oil clearance		Mag	.0014-.0029″ (.037-.075 mm)
			PTO	.0001-.0009″ (.005-.024 mm)
			Limit	.004″ (.10 mm)
Cylinder Head	Surface warpage limit			.0020″ (.05 mm)
	Standard height			4.975″ (126.4 mm)
Valve Seat	Contacting width **Measure valve stem height	In	Std	1.5255″ (38.75 mm)
			Limit	1.5425″ (39.18 mm)
		Ex	Std	1.5255″ (38.75 mm)
			Limit	1.5377″ (39.06 mm)
Valve Guide	Inner diameter			.2362-.2367″ (6.0-6.012 mm)
	Protrusion above head			.535-.551″ (13.6-14.0 mm)
Valve	Margin thickness	In	Std	.039″ (1.0 mm)
			Limit	.031″ (.8 mm)
		Ex	Std	.039″ (1.0 mm)
			Limit	.031″ (.8 mm)
Valve	Stem diameter		In	.2343-.2348″ (5.950-5.965 mm)
			Ex	.2341-.2346″ (5.945-5.960 mm)
	Stem oil clearance	Std	In	.0014-.0024″ (.035-.062 mm)
			Ex	.0016-.0026″ (.040-.067 mm)
		Limit		.0059″ (.15 mm)
	Overall length		In	4.031″ (102.4 mm)
			Ex	4.059″ (103.1 mm)

ES50PL ENGINE SERVICE DATA

Valve Spring	Overall length Limit = –.079″ (–2.0 mm)	Inner	1.575″ (40.0 mm)
		Outer	1.650″ (41.9 mm)
	Squareness	Inner	.067-″ (1.7 mm)
		Outer	.071″ (1.8 mm)

Cylinder / Piston / Connecting Rod				**EH50PL12**
Cylinder	Surface warpage limit (mating with cylinder head)			.002″ (.05 mm)
	Cylinder bore		Std	3.9055-3.9062″ (99.20-99.22 mm)
	Taper limit			.002″ (.05 mm)
	Out of round limit			.002″ (.05 mm)
	Piston clearance		Std	.0018-.0025″ (.046-.065 mm)
			Limit	.0039″ (.10 mm)
Piston	Outer diameter	Std		3.9037-3.904″ (99.155-99.170 mm)
	Piston Pin Bore Standard I.D.			.9055-.9057″ (23.001-23.007 mm)
Piston Pin	Outer diameter			.9053-.9055″ (22.996-23.0 mm)
	Piston pin to pin bore clearance			.0002-.0004″ (.001-.0011 mm)
	Degree of fit			Piston pin must be a push (by hand) fit at 68° F (20° C)
Piston Ring to ring groove clearance		Top ring	Std	.0012-.0028″ (.030-.070 mm)
			Limit	.0059″ (.15 mm)
		Second ring	Std	.0012-.0028″ (.030-.070 mm)
			Limit	.0059″ (.15 mm)
Piston Ring installed gap		Top ring	Std	.008-.012″ (.20-.30 mm)
			Limit	.027″ (.7 mm)
		Second ring	Std	.014-.019″ (.35-.50 mm)
			Limit	.031″ (.8 mm)
		Oil ring	Std	.004-.019″ (.10-.50 mm)
			Limit	.039″ (1.0 mm)
Connecting Rod	Connecting rod small end ID			.9058-.9063″ (23.007-23.020 mm)
	Connecting rod small end radial clearance		Std	.0003-.0009″ (.007-.024 mm)
			Limit	.0020″ (.05 mm)
	Connecting rod big end side clearance		Std	.0035-.0196″ (.09-.50 mm)
			Limit	.0255″ (.65 mm)
	Connecting rod big end radial clearance		Std	.0004-.0015″ (.011-.038 mm)
			Limit	Same as standard
Crankshaft	Crankshaft runout limit			.0024″ (.06 mm)

KEY - Std: Standard; OS: Oversize; ID: Inner Diameter; OD: Outer Diameter; Mag: Magneto Side; PTO: Power Take Off Side

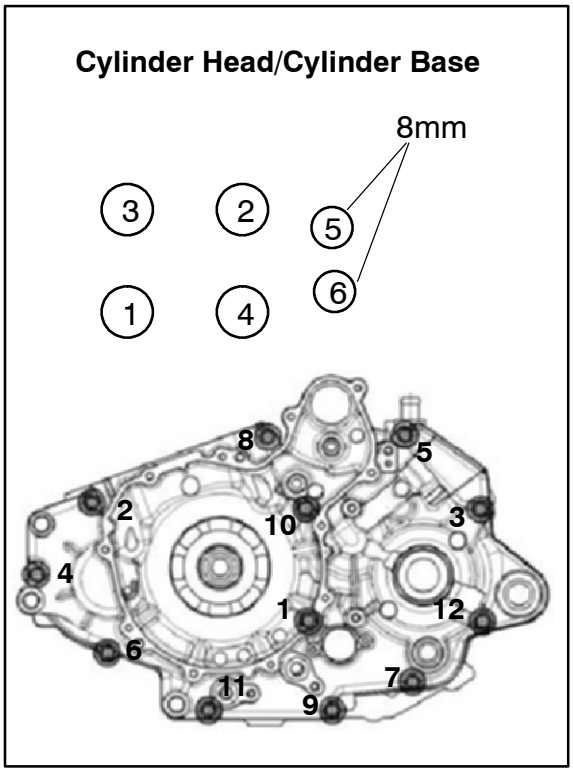
SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
2872105	Water Pump Mechanical Seal Puller
2200634	Valve Seat Reconditioning Kit
2870390	Piston Support Block
PA-45958	Cam Chain Tensionor Assembly Tool
PA-46075	Flywheel Puller
PA- 46076	MAG End Crankshaft Nut Remover/Installer
PA-46087	Crankcase Separator
PA-46077	MAG End Crankshaft Installer
2871283	Crankshaft/Water Pump Seal Install Kit
5131135	Water Pump Install Kit
PA-46502	Valve Spring Compressor

ENGINE FASTENER TORQUE PATTERNS

Tighten cylinder head, cylinder base, and crankcase fasteners in 3 steps following the sequence outlined below.

Cylinder Head/Cylinder Base



PISTON IDENTIFICATION

The piston <u>may or may not</u> have an identification mark for piston placement. If the piston has an identification mark, follow the directions for piston placement below. If the piston does not have an identification mark, the direction for placement of the piston does not matter.

Note the directional and identification marks when viewing the pistons from the top. Identifying marks such as "F", " → ", " ▶" or • must always be positioned to the flywheel side of the engine. Other marks are used for identification as to diameter, length and design. Four stroke engine rings are a rectangular profile. See text for oil control ring rail installation. Use the information below to identify pistons and rings:

COMPRESSION TEST

NOTE: This engine has built-in decompression components. Compression readings will vary in proportion to cranking speed during the test. Average compression (measured) is about **85-90 psi @ 400 RPM** during a compression test.

A cylinder leakdown test is the best indication of engine condition. Follow manufacturer's instructions to perform a cylinder leakage test. (Never use high pressure leakage testers, as crankshaft seals may dislodge and leak).

Cylinder Compression w/ decompression

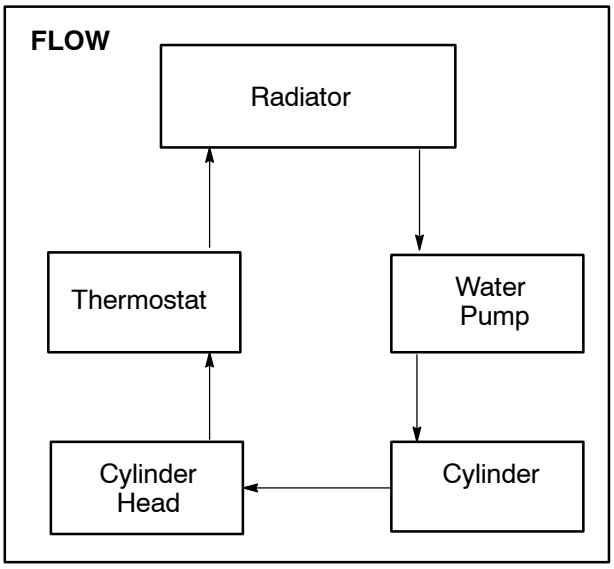
Standard: 85-90 PSI @ 400 RPM

Cylinder Leakdown

Service Limit 10 %
(Inspect for cause if leakage exceeds 10%)

COOLING SYSTEM

WARNING: Never remove radiator cap when engine is warm or hot. The cooling system is under pressure and serious burns may result. Allow the engine and cooling system to cool before servicing.



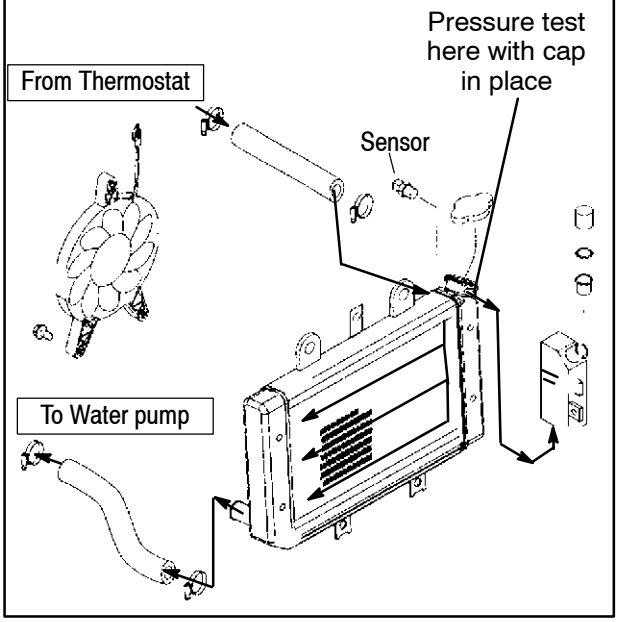
RADIATOR CAP / SYSTEM PRESSURE TEST

1. Remove recovery bottle hose from coolant filler neck.
2. Connect a Mity Vac™ (**PN 2870975**) to radiator and pressurize system to 10 PSI. The system must retain 10 lbs of pressure for five minutes or longer. If pressure loss is evident within five minutes, check radiator, all cooling system hoses and clamps, or water pump seal.

Radiator Cap Pressure Test

1. Remove radiator cap and test using a cap tester (commercially available).
2. The radiator cap relief pressure is 13 psi. for all models. Replace if cap releases at less than 13 psi.

Coolant Flow Diagram



COOLING SYSTEM SPECIFICATIONS

Description	Temperature
Fan Switch (Off) Fan Switch (On)	150° F (65° C) ± 8° 180° F (82° C) ± 7°
Hot Light On	221° F (105° C)
System Capacity	2.25 Quarts (2.1 L)
Radiator Cap Relief Pressure	13 PSI

RECOMMENDED COOLANT

Use only high quality antifreeze/coolant mixed with *distilled* water in a 50/50 or 60/40 ratio, depending on freeze protection required in your area. **CAUTION:** Using tap water in the cooling system will lead to a buildup of deposits which may restrict coolant flow and reduce heat dissipation, resulting in possible engine damage. Polaris Premium 60/40 Antifreeze/Coolant (**PN 2871323**) is recommended for use in all cooling systems and comes pre-mixed, ready to use.

ACCESSIBLE COMPONENTS

The following components can be serviced or removed with the engine installed in the frame:

- Flywheel
- Alternator/Stator
- Starter Motor/Starter Drive
- Water Pump / Water Pump Mechanical Seal*

***Mechanical Water Pump Seal Removal Tool (**PN 2872105**) is required to replace mechanical seal with engine in frame.

The following components require engine removal for service:

- Counterbalance Shaft or Bearing(s)
- Connecting Rod
- Crankshaft
- Crankshaft Main Bearings
- Cylinder Head
- Cylinder
- Piston/RIngs
- Camshaft
- Cams
- Cam Chain and Sprockets
- Transmission Gears and Bearings

ENGINE REMOVAL

1. Thoroughly clean the ATV engine and chassis.
2. Clean work area.
3. Support the ATV with jackstands under the footrests at a height sufficient to raise the rear wheels off the floor at least 5 inches (12.7 cm)
4. Drain coolant and engine oil.
5. Disconnect battery cables, starting with the negative (-) cable first.
6. Remove the following components:
   - Seat
   - Front Cab (Refer to Chapter 5)
   - Fuel Tank (Refer to Chapter 4)
   - RH footwell (Refer to Chapter 5)
7. Remove air intake duct.
8. Remove carburetor (Caution: fuel will leak if carb is turned upside down). In most instances, the carburetor will not have to be disconnected from the throttle cable, choke cable and fuel line for engine removal. Insert a shop towel into the carburetor flange to prevent dirt from entering the intake of the engine.
9. Disconnect all electrical connections to the engine. (coolant sensor, neutral switch, plug wire, starter cable, ground cable,) Remove the magneto side cover, leaving the electrical components attached, and secure out of the way.
10. Remove clutch linkage and secure out of the way.
11. Remove fasteners from exhaust pipe and remove header pipe.
12. Remove oil tank and hoses as an assembly. Disconnect vent line and secure out of the way.
13. Loosen chain, disconnect and remove . NOTE: An acceptable alternative is to remove the transmission drive sprocket and roll chain off.
14. Remove all engine mount nuts and engine mount plates, starting at the rear with the combination engine/swing arm pivot mount first. Using a suitable tool, push the bolt out far enough to loosen the engine, but not drop the swing arm pivot. Use a jack under the bearing carrier to relieve tension from the pivot bolt for easier removal and installation.
15. With an assistant helping you, remove the engine by tilting forward and turning to exit through left side of frame.

To reinstall the engine, reverse the procedures. Refer to engine installation notes on Page 3.8.

ENGINE INSTALLATION NOTES

After the engine is installed in the frame, review this checklist and perform all steps that apply:

General Items

- Install previously removed components using new gaskets, seals, and fasteners where applicable.
- Perform checks on fluid levels, controls, and all important areas on the vehicle as outlined in the daily pre-ride inspection checklist (refer to Chapter 2 or the Owner's Manual).
- Verify clutch and lever freeplay according to procedures on Page 2.9.
- Adjust chain tension according to procedures on Page 2.25.

Exhaust

- Replace exhaust gaskets. Seal connections with high temp silicone sealant if applicable.
- Verify all fasteners are in good condition and torqued properly.

Bleed Cooling System

NOTE: Refer to Page 3.6 for hose routing. Bleeding generally is necessary after repairs to purge any air that may remain in the system during filling.

1. Remove radiator cap and slowly add coolant to the bottom of filler neck.
2. Fill coolant reservoir tank to full mark.
3. Install radiator cap half-way and gently squeeze coolant hoses to force any trapped air out of system.
4. Again, remove radiator cap and slowly add coolant to the bottom of fill neck if required.
5. Start engine and observe coolant level in the radiator. Allow air to purge and top off as necessary. Reinstall radiator cap and bring engine to operating temperature. After engine is cool, check level in reservoir tank and add coolant if necessary.

NOTE: Should the reservoir tank become empty, it will be necessary to refill at the radiator and repeat the bleeding procedure.

Engine Break In Period

The break in period for a Polaris ATV engine is defined as the first ten hours of operation, or the time it takes to use two full tanks of gasoline. No single action on your part is as important as a proper break in period. Careful treatment of a new engine will result in more efficient performance and longer life for the engine. Perform the following procedures carefully.

New and rebuilt engines require a break-in oil change at 1 hour of engine run time.

OIL RECOMMENDATION

Polaris PS-4 All Season synthetic oil is specially formulated for use with wet-clutch transmissions. Never substitute or mix oil brands. Serious engine damage and voiding of warranty can result.

For new or rebuilt engines, do not operate at full throttle or high speeds for extended periods during the first three hours of use. Excessive heat can build up and cause damage to close fitted engine parts.

1. Fill fuel tank with unleaded or leaded fuel which has a minimum pump octane number of 87= (R+ M)/2.
2. Check oil reservoir level indicated on dipstick. Add oil if necessary.

3. Drive slowly at first to gradually bring engine up to operating temperature.
4. Vary throttle positions. Do not operate at sustained idle or sustained high speed.
5. Perform regular checks on fluid levels, controls and all important areas on the vehicle.
6. Pull only light loads during initial break in.
7. Change break in oil and filter at 1 hour or 100 miles.

CRANKSHAFT STRAIGHTENING

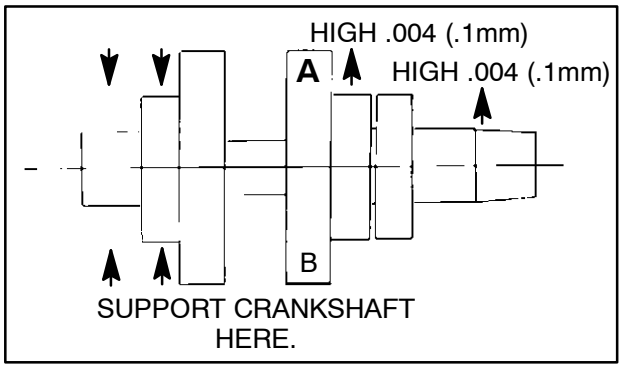
Lubricate the bearings and clamp the crankshaft securely in the crankshaft alignment fixture. Refer to the illustrations below.

Crankshaft Alignment Fixture

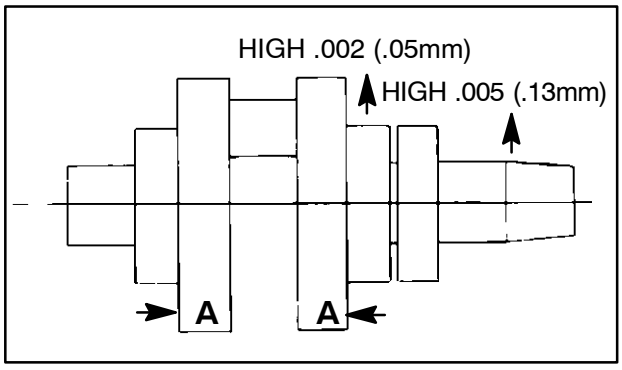
(PN 2870569)

NOTE: The rod pin position in relation to the dial indicator position tells you what action is required to straighten the shaft.

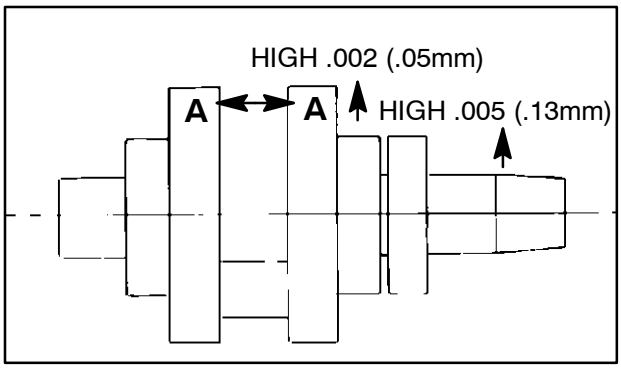
1. To correct a situation like the one shown in the illustration, strike the shaft at point A with a brass hammer.



2. To correct a situation like the one shown in the illustration, squeeze the crankshaft at points A. (Use tool from alignment kit).



3. If the crank rod pin location is 180° from the dial indicator (opposite that shown above), it will be necessary to spread the crankshaft at position A as shown in the illustration at right. When rebuilding and straightening a crankshaft, runout must be as close to zero as possible.



NOTE: Maximum allowable runout is .0024″

ES50PL ENGINE LUBRICATION

Oil Type:
Polaris PS-4 Synthetic **(PN 2874414)**

Capacity:
Approximately 2.25 U.S. Quarts (2.1L)

Filter:
PN 3084963

Drain Plug / Screen Fitting:
14.8-17 ft. lbs. (20-23 Nm)
(If fitting is removed, follow oil pump priming procedure).

Oil Pressure Specification:
20 PSI @ 5500 RPM, Polaris PS-4 Synthetic (Engine Hot)

OIL PRESSURE TEST

1. Remove blind plug on front right oil filter cover.
2. Insert a 1/8 NPT oil pressure gauge adaptor and attach the gauge.
3. Start engine and allow it to reach operating temperature, monitoring gauge indicator.

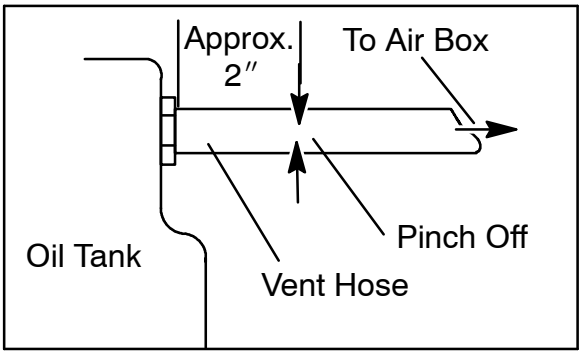
NOTE: Use only Polaris PS 4 Synthetic Engine Lubricant (**PN 2874414**).

Oil Pressure at 5500 RPM (Engine Hot):
Standard: 20 PSI
Minimum: 12 PSI

OIL PUMP PRIMING PROCEDURE

NOTE:Oil pump priming procedures must be performed whenever the oil hose connection between the oil tank and pump inlet has been disconnected.

1. Clamp or pinch off vent line approximately 2″ from oil tank, between the end of oil tank vent fitting and the vent line.



2. Run engine for 15–20 seconds at 3000–4000 rpm.
3. Shut off engine. Remove the vent line clamp. The oil pump should now be properly primed and ready for field operation. **Note:** If the system is primed properly you should hear some air release, if you do not, the system has not primed. repeat the process if necessary.

OIL FLOW - ES50PL

The chart on Page 3.11 describes the flow of oil through the ES50PL engine. Beginning at the oil tank, the oil flows through a screen fitting in the bottom of the tank and into the oil supply hose. The feed side of the oil pump draws oil through the hose and into the crankcase oil gallery, pulling the oil through another passage to the one way valve. (When the engine is off, the one way valve closes to prevent oil in the tank from draining into the crankcase.) Oil is then pumped to the oil filter. If the oil filter is obstructed, a bypass valve contained in the filter allows oil to bypass the filter element.

At this point, the oil is diverted in three directions. Oil is supplied to the crankshaft through a pto side oil passage, lubricating the crank bearings, crankpin, piston, cylinder and connecting rod bearings. A delivery pipe supplies oil to the top of the cylinder head and the transmission main shaft. Oil is delivered though the pipe and enters the camshaft through the cam support oil gallery. The camshaft journals are lubricated through holes in the camshaft. Oil lubricates the cam chain sprockets and cam lobes via an oil jet, which drains to the crankcase.

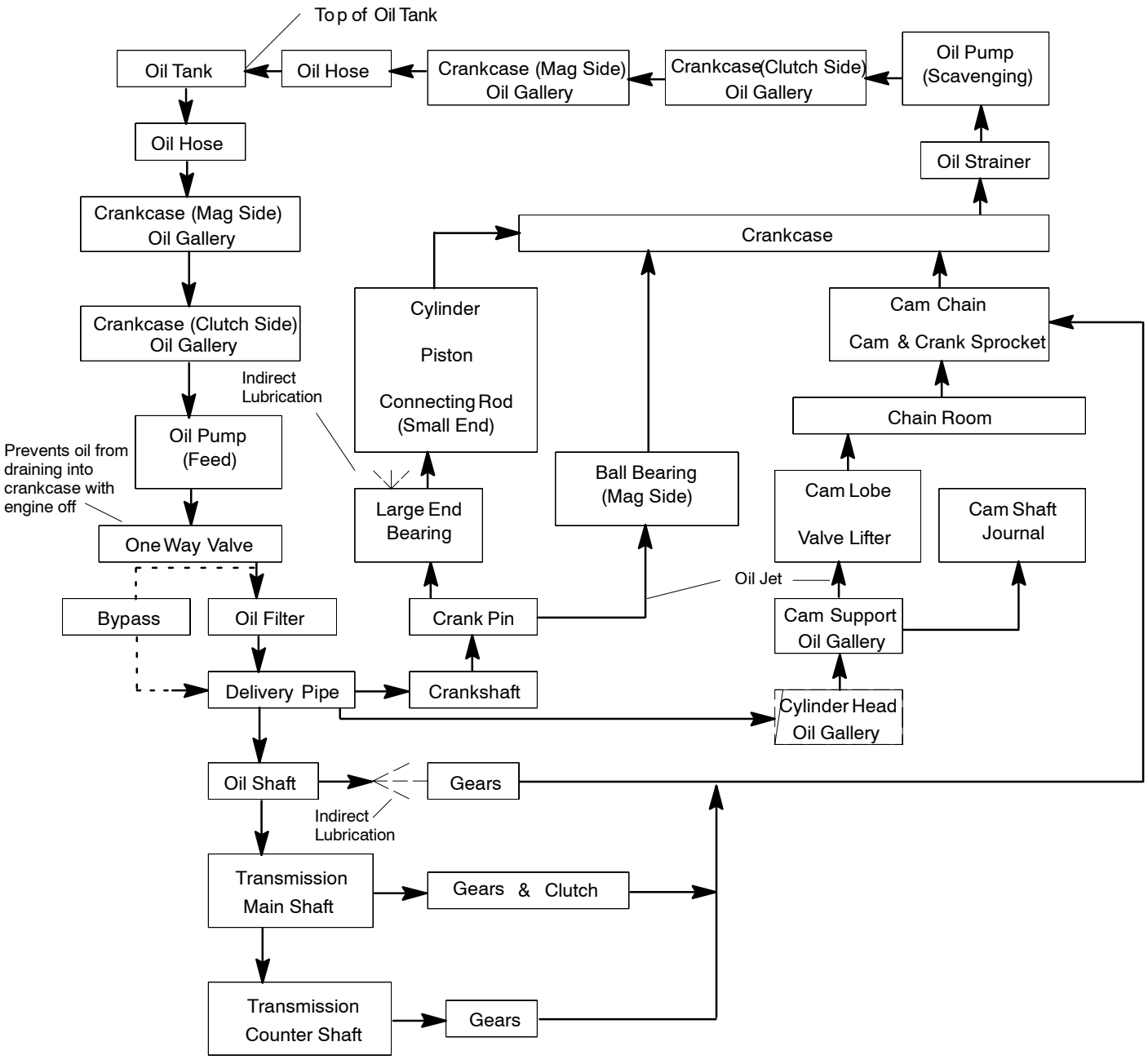
Another oil path flows from the delivery pipe to the transmission main shaft. Here it passes through the oil gallery to lubricate the transmission gears, clutch and bearings.

Residual oil from the lubrication of the crankshaft and connecting rod indirectly lubricates the cylinder wall, piston, rings, connecting rod small end bearing, piston pin, oil/water pump drive gears, cam chain, drive sprocket, and Magneto end crankshaft main bearing.

A one-way valve is located on the right front (PTO) side of the crankcase. This valve prevents oil in the tank from draining into the engine crankcase when the engine is off. The valve mechanism consists of a plunger, return spring, guide plug, and sealing washer. When the engine is running, oil pressure lifts the plunger off the seat, allowing oil flow. When the engine is off, spring pressure forces the plunger against the oil passage seat, preventing oil flow from the tank to the sump. The one-way valve requires very little maintenance. If engine oil drains into the crankcase when the engine is off, inspect the valve sealing surface for debris or damage. Inspect the return spring for distortion or damage.

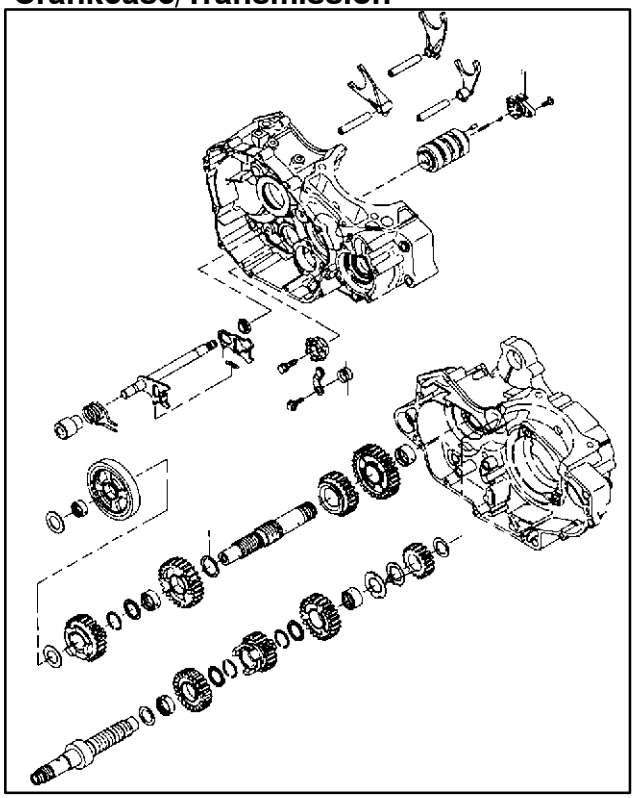
ES50PL OIL FLOW

ES50PL OIL FLOW CHART

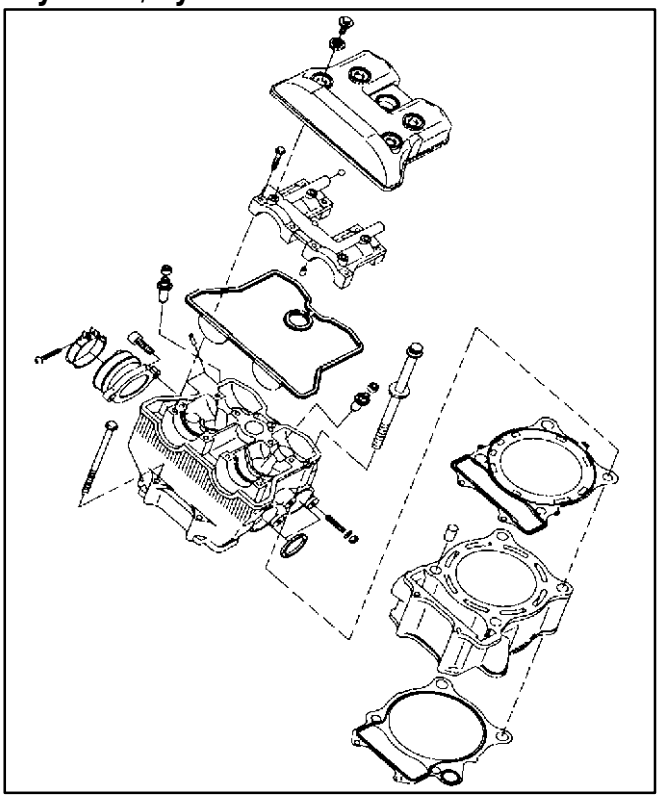


ES50PL ENGINE EXPLODED VIEWS

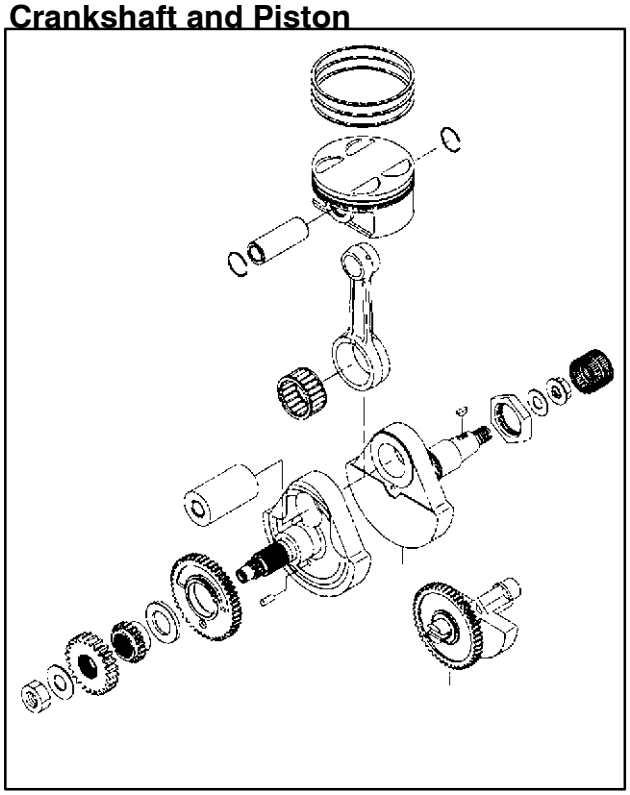
Crankcase/Transmission



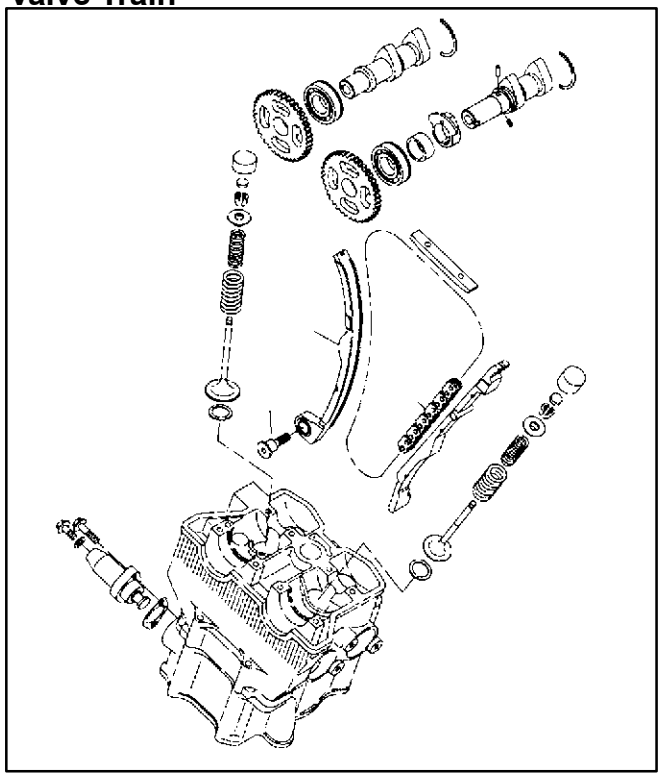
Cylinder/Cylinder Head



Crankshaft and Piston



Valve Train



ENGINE DISASSEMBLY

REFER TO PAGE 3.6-3.7 FOR ENGINE REMOVAL / INSTALLATION NOTES

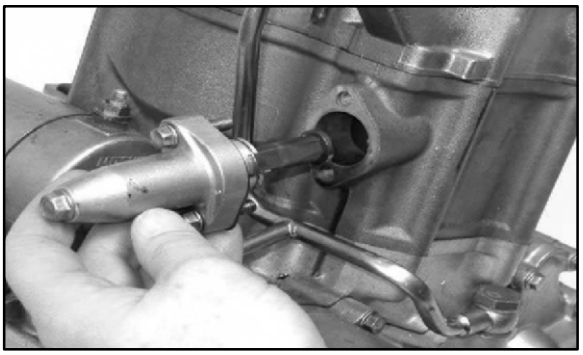
CAM CHAIN TENSIONER/ CAMSHAFT REMOVAL AND INSPECTION

1. Remove ignition timing inspection plug from recoil housing.

To position crankshaft at Top Dead Center (TDC) on the compression stroke:

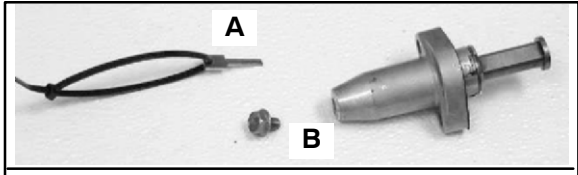
2. Rotate engine slowly in the direction of rotation watching intake valves open and start to close.
3. Continue to rotate engine slowly, watching for the camshaft sprocket marks and the “T” mark in the timing inspection hole.

4. Align the ”T” (TDC) mark on flywheel with the indent in the inspection hole and the cam sprockets marks (facing upward) aligned with the dots at the 12 o’clock and 9 o’clock positions. **NOTE:** The cam lobes should be laying flat and the valves have clearance at this point.
5. Remove the two 8x25 mm cam chain tensioner flange bolts.



6. If tensioner remains in place, tap lightly on tensioner body with a soft face hammer and remove tensioner. **CAUTION:** The assembly is under spring tension. Maintain inward pressure while removing.
7. For installation, retract the plunger using the special tool and reverse the installation procedures using a new gasket. Tighten bolts to specification. (Pg 3.2)

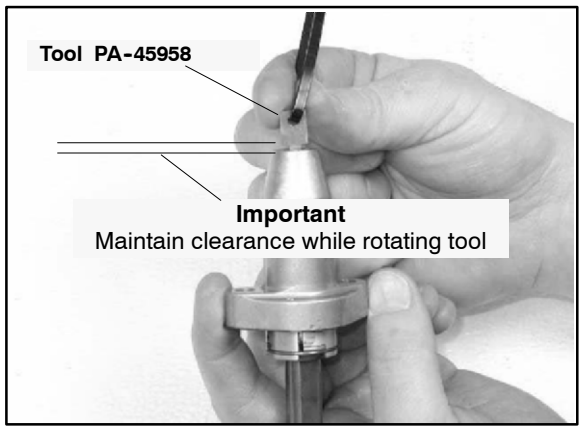
CAM CHAIN TENSIONER INSPECTION AND REASSEMBLY



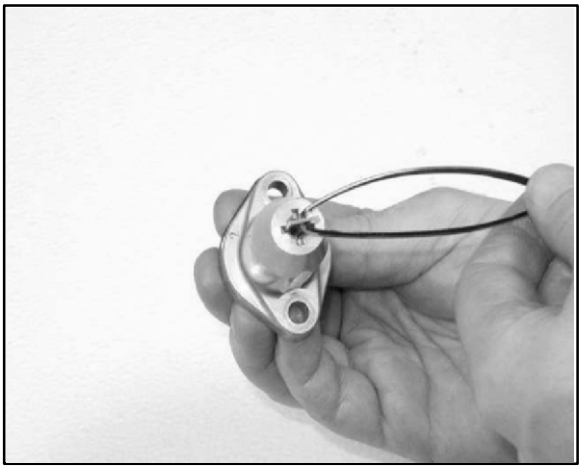
A - Tool PN PA-45958 **B - 10mm tensioner cap**

NOTE: The cam tensioner assembly is not a serviceable item. Replace assembly if problems are found. Spring tension may be relieved using the special tool prior to removal, but is not necessary.

1. When removed, the cam chain tensioner plunger should be extended outward to the end of its travel. Verify and inspect the plunger for wear or damage.
2. Push on the plunger. The plunger should not move in and out of the tensioner body.
3. To release the plunger tension and prepare for reassembly, remove the 10mm plug and insert the Cam Chain Tensioner Tool (**PA-45958**), lodging the tip of the tool into the spring.



4. To retract the plunger, rotate the special tool clockwise while holding the tensioner stationary. You may also hold the special tool stationary and rotate the tensioner assembly counter-clockwise if desired. **IMPORTANT**: Do not grind edges of key flange into tensioner to prevent damage to the tool or locking guides during plunger retraction.
5. Once retraction is complete, lock the tool into the tensioner guides. This holds the spring and plunger in place for reassembly. Use caution not to disturb the tool during tensioner installation.

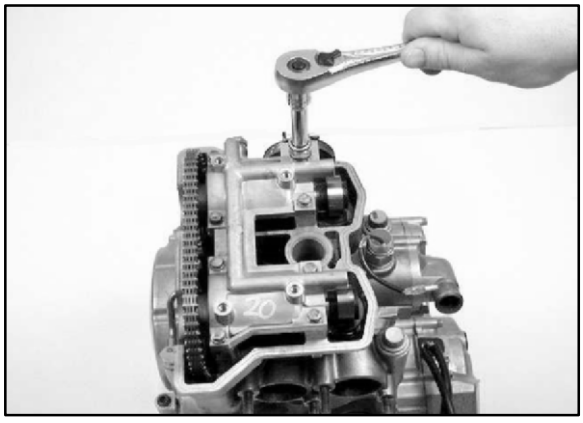


6. Reinstall the tensioner assembly, torquing the bolts to specification (Pg 3.2). Remove the special tool and replace the tensioner cap.

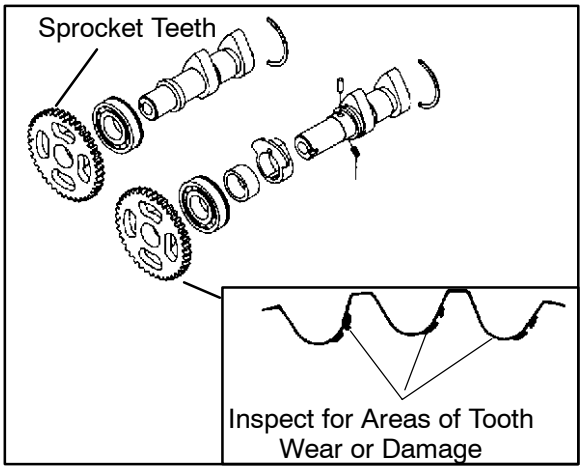
Tensioner Bolt Torque:

6.6-8.1 ft lbs (9-11 Nm)

CAMSHAFT REMOVAL AND INSPECTION

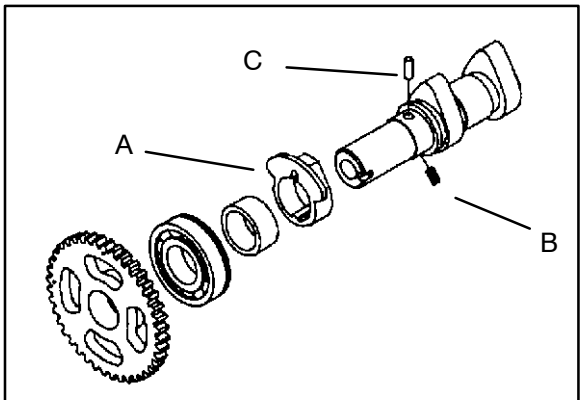


1. Remove the valve cover.
2. Remove the tensioner assembly.
3. Remove the 8 bolts securing the cam tower assembly and remove the cover.
4. To free the cam assembly, lift one cam assembly and slightly rotate it while removing the chain from the cam gear. Repeat this procedure for the other cam. **NOTE: Do not allow cam chain to drop into the engine if no other disassembly is being performed.**
5. Use a device to secure the cam chain, such as mechanic's wire or nylon line, to prevent it from falling into the engine.
6. Inspect cam sprocket teeth for wear or damage. If damage is found, replace the camshaft assembly.



AUTOMATIC COMPRESSION RELEASE INSPECTION

NOTE: The automatic compression release mechanism **cannot** be serviced. The components are not replaceable. Replace the camshaft as an assembly if any part of the compression release is worn or damaged.

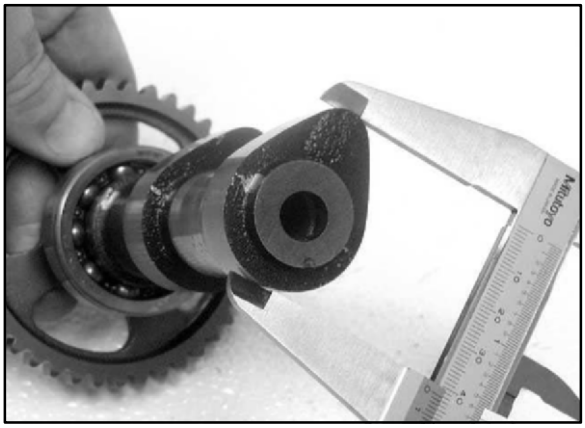


Note: Cam and compression-release are an assembly and not serviceable

1. Check release cam (A) for smooth operation throughout the entire range of movement. The spring (B) should hold the cam against the stop. In this position, the actuator (C) will be held outward in the compression release mode.
2. Inspect lobe on end of release cam for wear. Replace cam assembly if necessary.

CAMSHAFT INSPECTION

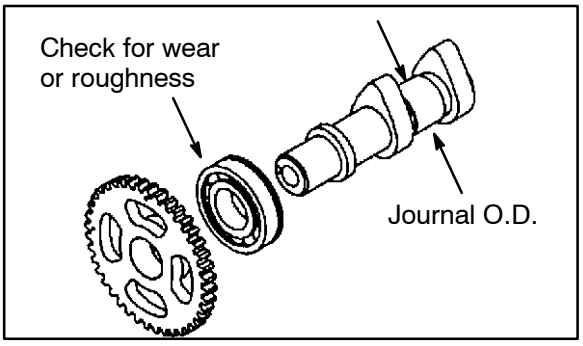
1. Visually inspect each cam lobe for wear, chafing or damage. NOTE: cams, gears and bearings are not serviceable. Replace cam as an assembly if problems are found.
2. Inspect the cam bearings for excess play or noise during rotation.
3. Measure height of each cam lobe using a micrometer. Compare to specifications.



Camshaft Lobe Height :

Limit: 1.6555″ (42.05 mm)

4. Measure camshaft journal outside diameter (O.D.)



Camshaft Journal O.D.:

Mag End: .9821-.9828″
(24.946-24.963 mm)

5. Measure ID of camshaft journal bore.

Camshaft Journal I.D.:

Mag End: .9842-.9851″
(25.00-25.021 mm)

NOTE: Replace camshaft as an assembly if damaged or if any part is worn past the service limit.

6. Calculate oil clearance by subtracting journal OD from journal bore ID. Compare to specifications.

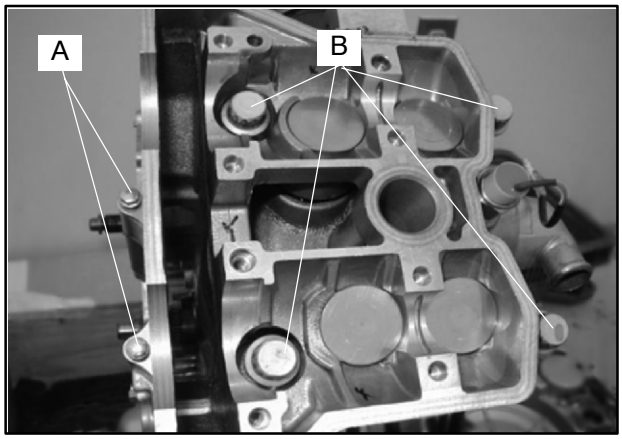
Camshaft Oil Clearance:

Limit: .0039″ (.10 mm)

NOTE: Replace cylinder head if camshaft journal bore is damaged or worn excessively.

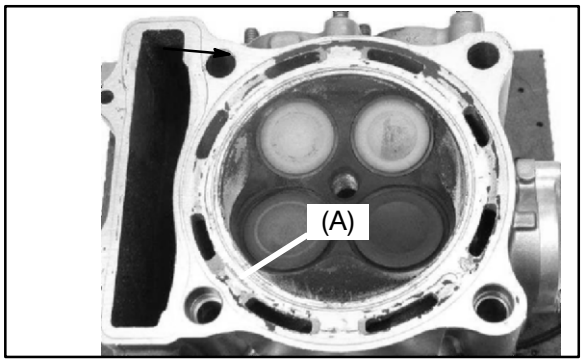
CYLINDER HEAD REMOVAL ES50PL

1. Remove the cam shafts.
2. Remove the two 8mm flange bolts (A) from cylinder head.
3. Loosen each of the four cylinder head bolts (B) with a 14mm 12-point socket, turning evenly 1/8 turn each time in a criss-cross pattern until loose.



4. Remove bolts (B) and tap cylinder head lightly with a soft-face hammer until loose.
   CAUTION: Tap only in reinforced areas or on thick parts of cylinder head casting to avoid damaging the head.
5. Remove cylinder head and head gasket.

CYLINDER HEAD INSPECTION



1. Thoroughly clean cylinder head (A) surface to remove all traces of gasket material and carbon. **CAUTION:** Use care not to damage sealing surface.

CYLINDER HEAD WARPAGE

1. Lay a straight edge across the surface of the cylinder head at several different points and measure warpage by inserting a feeler gauge between the straight edge and the cylinder head surface. If warpage exceeds the service limit, replace the cylinder head.

Cylinder Head Warpage Limit:

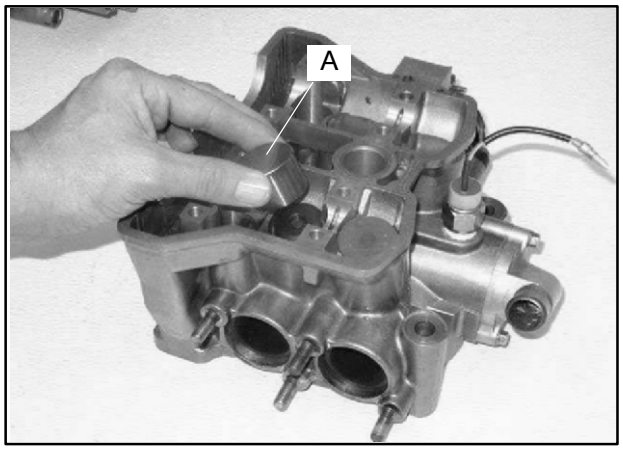
.002″ (.05 mm)

CYLINDER HEAD DISASSEMBLY

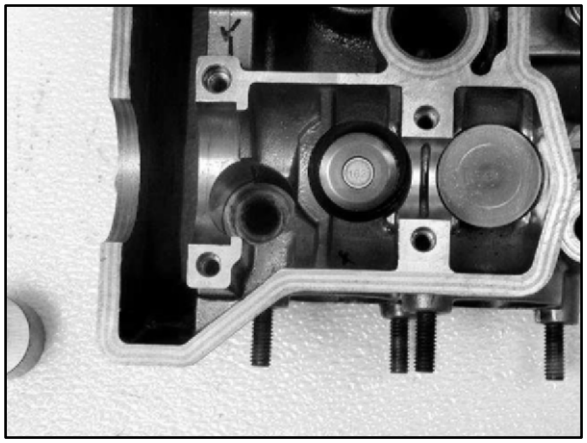
WARNING: Wear eye protection during cylinder head disassembly and reassembly.

NOTE: Keep all parts in order with respect to their location in the cylinder head.

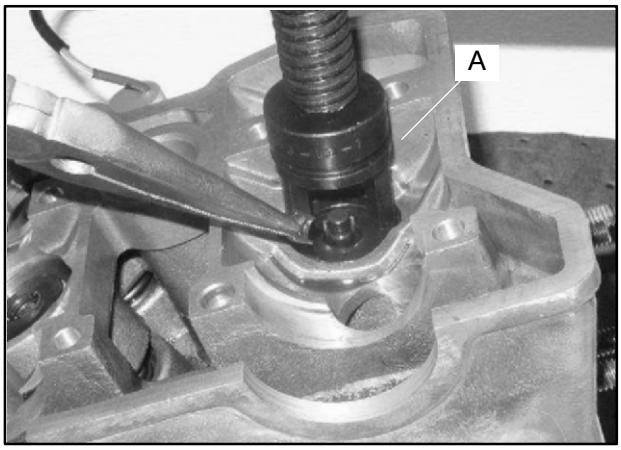
2. Remove the valve buckets (A). **NOTE:** Keep all parts in order with respect to their location in the cylinder head. Use care not to mar or damage the buckets upon removal.



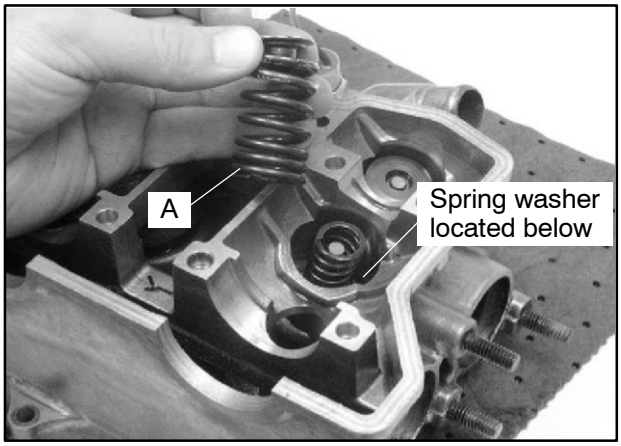
3. Under each bucket is a valve shim. Record and keep these shims oriented to each valve disassembled.



4. Using Valve Spring Compressor (**PA-46502**) (A), compress the valve springs and remove the split keepers. **NOTE:** To prevent loss of tension, do not compress the valve springs more than necessary.

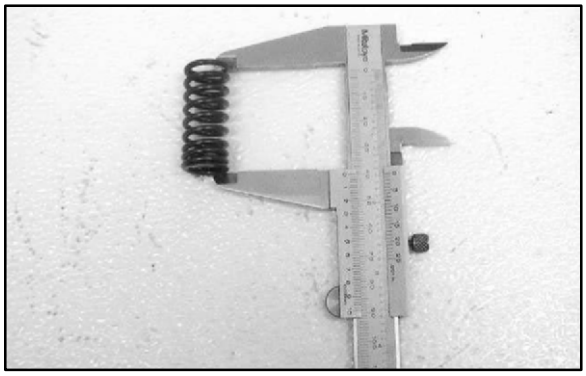


5. Remove spring retainer, inner and outer springs and spring washer.

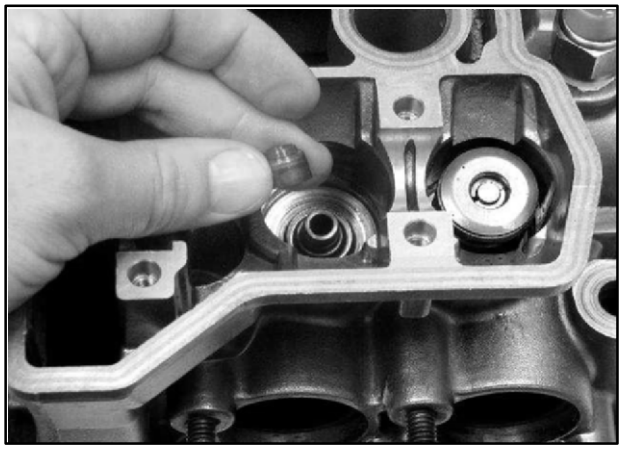


NOTE: The valve springs should be positioned with the tightly wound coils against the cylinder head (A).

6. Push valve out, keeping it in order for reassembly in the same guide.
7. Measure free length of the inner and outer springs with a Vernier caliper. Check springs for squareness. Compare to specifications. Replace inner and outer springs as a set if either measurement is out of specification.

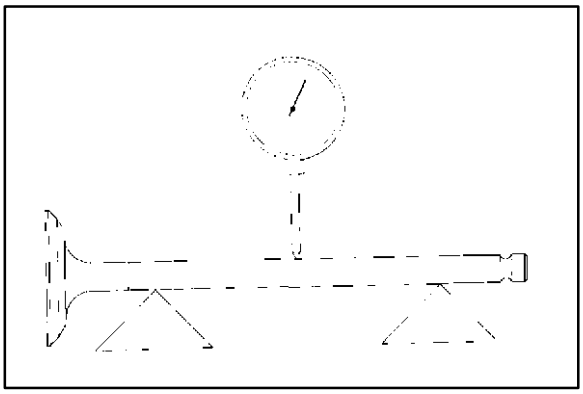


8. Remove the valve seals. **NOTE:** Replace seals whenever the cylinder head is disassembled. Hardened, cracked or worn valve seals will cause excessive oil consumption and carbon buildup.

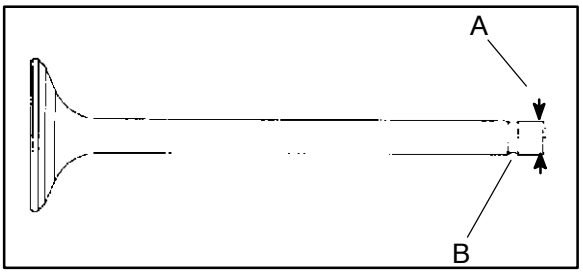


VALVE INSPECTION

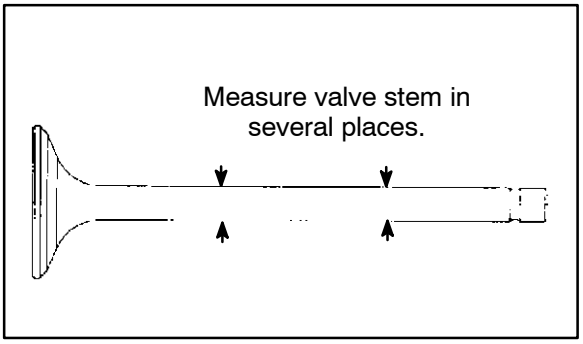
1. Remove all carbon from valve with a soft wire wheel.
2. Check valve face for runout, pitting, and burned spots. To check for bent valve stems, mount the valve in “V” blocks and use a dial indicator.



3. Check end of valve stem for flaring, pitting, wear or damage (A).



4. Inspect split keeper groove for wear or flaring of the keeper seat area (B). **NOTE:** The valves cannot be re-faced or end ground. Valves must be replaced if worn, bent, or damaged.
5. Measure diameter of valve stem with a micrometer in three places and in two different directions (six measurements total). Compare to specifications.



Valve Stem Diameter:

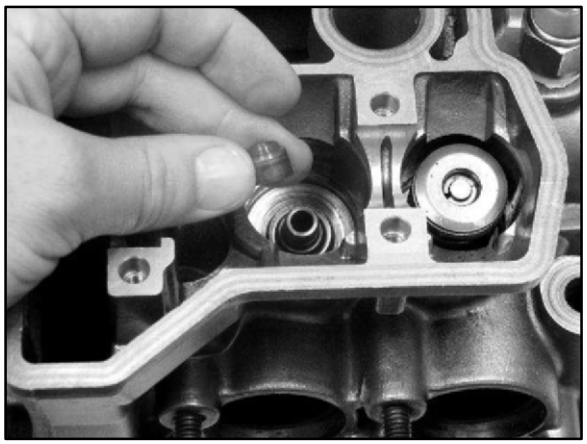
Intake: .2343-.2348″ (5.950-5.965 mm)
Exhaust: .2341-.2346″ (5.945-5.960 mm)

CYLINDER HEAD ASSEMBLY

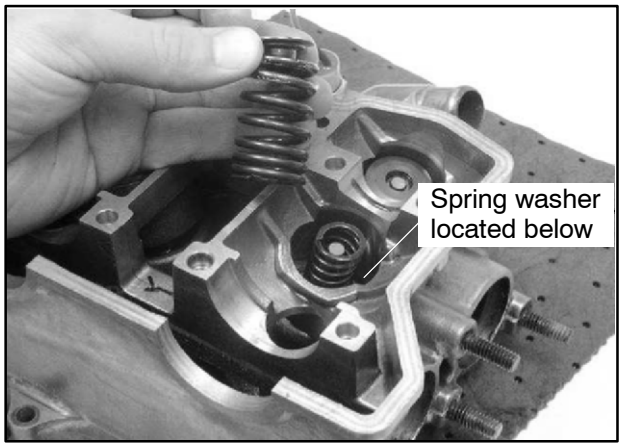
CAUTION: Wear eye protection during assembly.

NOTE: Assemble the valves one at a time to maintain proper order.

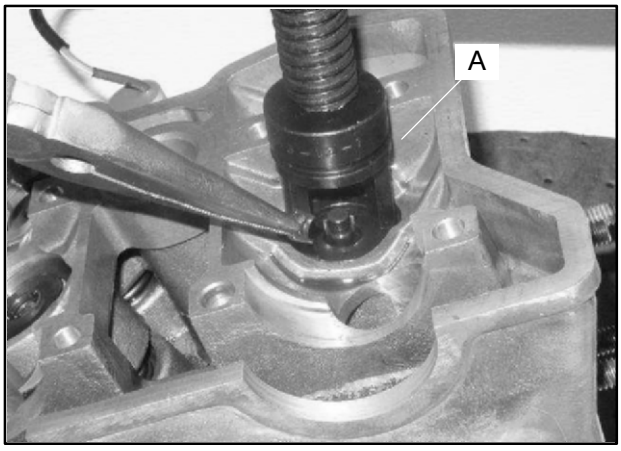
1. Install new valve seals on valve guides.



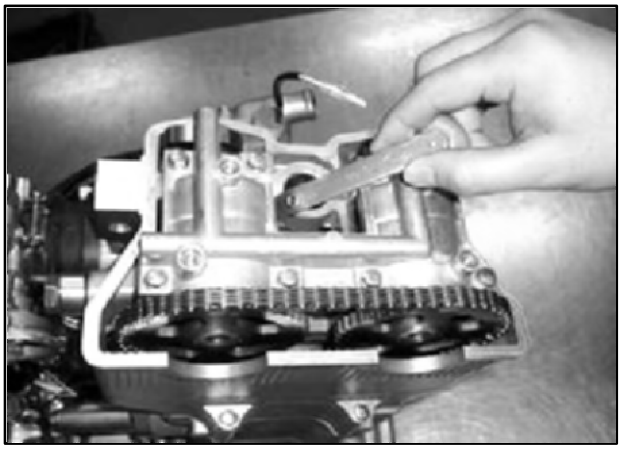
2. Apply engine oil to valve guides and seats.
3. Coat valve stem with assembly lube.
4. Install valve carefully with a rotating motion to avoid damaging valve seal.
5. Install spring washers. Dip valve springs and retainer in clean engine oil and install springs with closely spaced coils toward the cylinder head.



6. Place retainer on springs and install valve spring compressor. Compress springs only enough to allow split keeper installation and prevent loss of spring tension. Install split keepers with the gap even on both sides.



7. Repeat procedure for remaining valves.
8. When all valves are installed, tap lightly with soft faced hammer on the end of the valves to seat the keepers.
9. Install the shims and buckets for each valve in the order they were removed.
10. Check valve clearance with engine at Top Dead Center (TDC). **NOTE:** Repairs such as valve grinding or valve replacement will require re-shimming for proper valve clearance. Use the chart provided on page 3.20 to determine the appropriate shim thickness.



Valve Clearance(Engine Cold):

Intake: .006″ (.15mm)
Exhaust: .010″ (.27mm)
+ / - .0019″ (.05mm)

ES50PL Adjusting Pad Selection Matrix

1. Measure valve clearance at TDC (Compression stroke) using thickness gauge with original adjusting pad installed.
2. Reference the measurement and the 3 digits marked on the existing adjusting pad on the matrix below
3. Select a suitable adjusting pad from the matrix below and replace existing pad
4. Measure and confirm that valve clearance is within the standard values
5. If valve clearance is not within standard, reverify step #1 and repeat procedures again

Example:

Intake – Valve clearance before adjusting: 0.23mm (.009")
Exsisting adjusting pad mark: 177
From "Intake Adjusting Pad Selection Matrix", a suitable adjusting pad would be **185**

Exhaust – Valve clearance before adjusting: 0.35mm (.0137")
Exsisting adjusting pad mark: 177
From "Exhaust Adjusting Pad Selection Matrix", a suitable adjusting pad would be **185**

<Intake ---Adjusting Pad Selection Matrix>

Valve Clearance before adjusting (mm)	Exsisting Adjusting Pad Marking (numeral mark w/ 3 digits on Adjusting Pad)																													
	145	150	155	160	162	165	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	225	230
	Suitable Adjusting Pad Marking (numeral mark w/ 3 digits on Adjusting Pad)																												
0.00-0.04			145	150	150	155	155	160	160	162	165	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	207	212	220
0.05-0.09		145	150	155	155	160	160	162	165	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	212	220	225
0.10-0.20 (=Standard)	Exsisting Adjusting pad = Suitable Adjusting pad																												
0.21-0.25	155	160	162	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	230		
0.26-0.30	160	162	167	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230			
0.31-0.35	162	167	172	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230				
0.36-0.40	167	172	177	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230						
0.41-0.45	172	177	182	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230								
0.46-0.50	177	182	187	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230										
0.51-0.55	182	187	192	197	200	202	205	207	210	212	215	220	220	225	225	230	230												
0.56-0.60	187	192	197	202	205	207	210	212	215	220	220	225	225	230	230														
0.61-0.65	192	197	202	207	210	212	215	220	220	225	225	230	230																
0.66-0.70	197	202	207	212	215	220	220	225	225	230	230																		
0.71-0.75	202	207	212	220	220	225	225	230	230																				
0.76-0.80	207	212	220	225	225	230	230																						
0.81-0.85	212	220	225	230	230																								
0.86-0.90	220	225	230																										
0.91-0.95	225	230																											
0.96-1.00	230																												

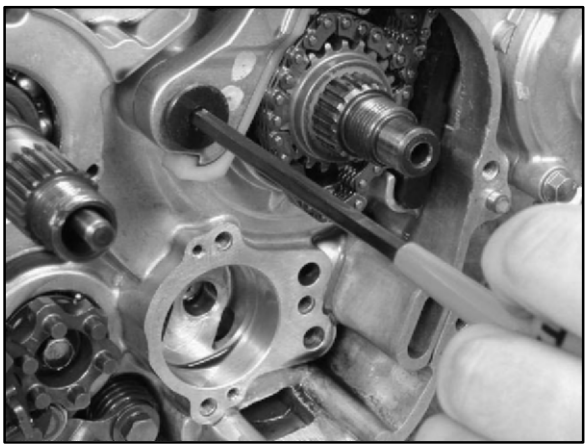
<Exhaust ---Adjusting Pad Selection Matrix>

Valve Clearance before adjusting (mm)	Exsisting Adjusting pad (numeral mark w/ 3 digits on Adjusting Pad)																													
	145	150	155	160	162	165	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	225	230
	Exsisting Adjusting pad = Suitable Adjusting pad																												
0.02-0.06						145	145	150	150	155	155	160	160	162	165	167	170	172	175	177	180	182	185	187	190	192	197	202	207
0.07-0.11				145	145	150	150	155	155	160	160	162	165	167	170	172	175	177	180	182	185	187	190	192	195	197	202	207	212
0.12-0.16			145	150	150	155	155	160	160	162	165	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	207	212	220
0.17-0.21		145	150	155	155	160	160	162	165	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	212	220	225
0.22-0.32	std																												
0.33-0.37	155	160	162	167	170	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	230		
0.38-0.42	160	162	167	172	175	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230			
0.43-0.47	162	167	172	177	180	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230				
0.48-0.52	167	172	177	182	185	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230						
0.53-0.57	172	177	182	187	190	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230								
0.58-0.62	177	182	187	192	195	197	200	202	205	207	210	212	215	220	220	225	225	230	230										
0.63-0.67	182	187	192	197	200	202	205	207	210	212	215	220	220	225	225	230	230												
0.68-0.72	187	192	197	202	205	207	210	212	215	220	220	225	225	230	230														
0.73-0.77	192	197	202	207	210	212	215	220	220	225	225	230	230																
0.78-0.82	197	202	207	212	215	220	220	225	225	230	230																		
0.83-0.87	202	207	212	220	220	225	225	230	230																				
0.88-0.92	207	212	220	225	225	230	230																						
0.93-0.97	212	220	225	230	230																								
0.98-1.02	220	225	230																										
1.03-1.07	225	230																											
1.08-1.12	230																												

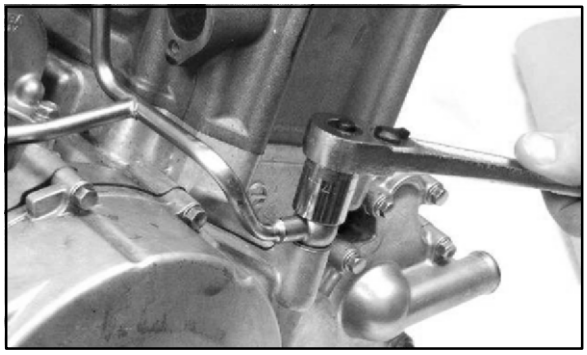
CYLINDER/PISTON REMOVAL AND INSPECTION

NOTE: Follow engine disassembly procedures to remove valve cover, camshafts and cylinder head. Removal of clutch basket is required for this procedure.

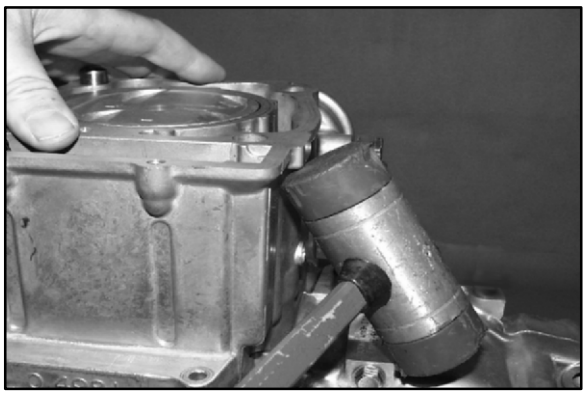
1. Using a 9/32" Allen wrench, remove the rear cam chain tensioner blade from the cylinder.



2. Loosen the 3 oil pipe banjo bolts, remove the bolts and sealing washers. Remove the pipes.



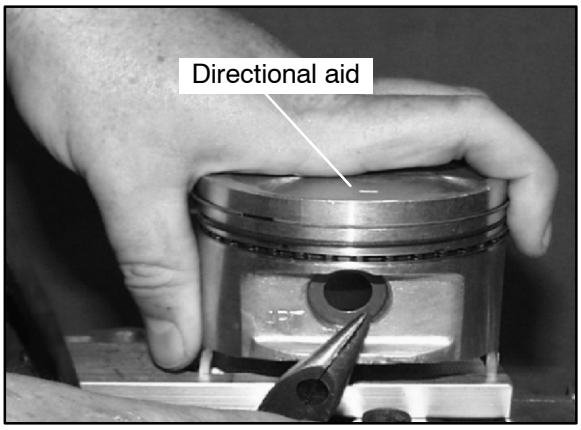
3. Tap cylinder lightly with a plastic hammer in reinforced areas until loose.



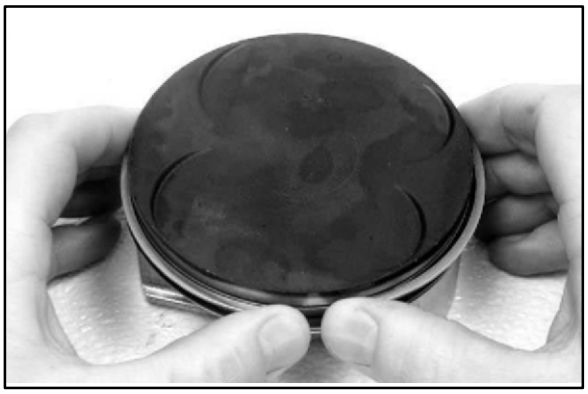
4. Rock cylinder forward and backward and lift it from the crankcase, exposing the piston and connecting rod. Support piston with Piston Support Block **(PN 2870390**).
5. Remove dowel pins from crankcase.

PISTON REMOVAL

1. Remove circlip. Note piston directional aid that is pointing toward the right (stator) side of engine.



2. Remove piston circlip and push piston pin out of piston. If necessary, heat the crown of the piston *slightly* with a propane torch to aid removal. **CAUTION:** Do not apply heat to the piston rings. The ring may lose radial tension.



3. Remove top compression ring.

***Using a piston ring pliers**: Carefully expand ring and lift it off the piston. **CAUTION:** Do not expand the ring more than the amount necessary to remove it from the piston, or the ring may break.

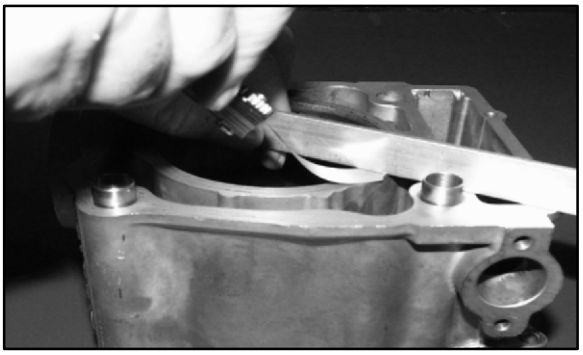
***By hand:** Placing both thumbs as shown, spread the ring open and push up on the opposite side. Take care to not scratch the ring lands.

4. Repeat procedure for second ring.

5. The oil control ring is a three piece design consisting of a top and bottom steel rail and center expander section. Remove the top rail first followed by the bottom rail, then remove the expander. For installation, refer to Page 3.35.

CYLINDER INSPECTION

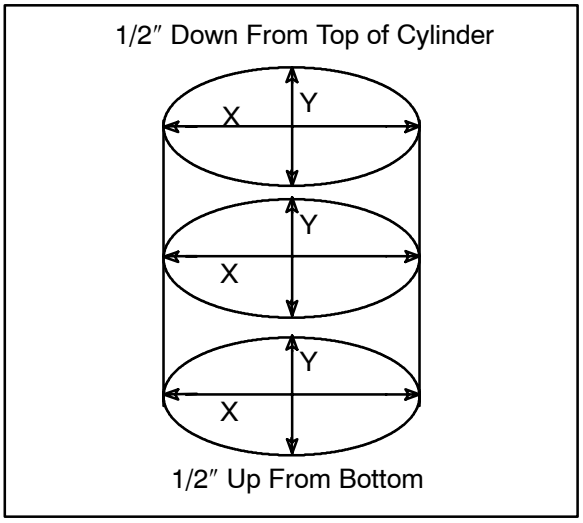
1. Remove all gasket material from the cylinder sealing surfaces.
2. Inspect the top of the cylinder for warpage using a straight edge and feeler gauge.



Cylinder Warpage:

.002″ (.05 mm)

3. Inspect cylinder for wear, scratches, or damage.



4. Inspect cylinder for taper and out of round with a telescoping gauge or a dial bore gauge. Measure in two different directions, front to back and side to side, on three different levels (1/2″ down from top, in the middle, and 1/2″ up from bottom).
5. Record measurements. If cylinder is tapered or out of round beyond specification, the cylinder must be replaced.

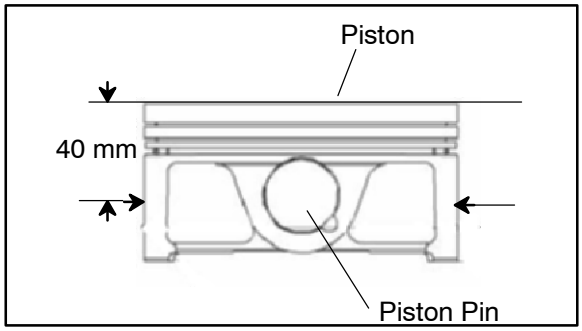
Cylinder Taper
Limit: .002″ (.05 mm) Max.
Cylinder Out of Round
Limit: .002″ (.05 mm) Max.

Standard Bore Size:

3.9055-3.9062″ (99.20-99.22mm)

PISTON-TO-CYLINDER CLEARANCE

1. Measure piston outside diameter at a point 40 mm down from the top of the piston at a right angle to the direction of the piston pin.



2. Subtract this measurement from the maximum cylinder measurement obtained in Step 5.

Piston to Cylinder Clearance

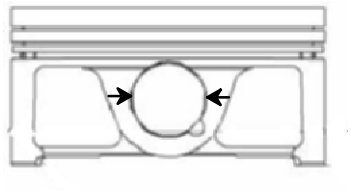
Std: 0018 - .0025″ (.046 - .065 mm)

Piston O.D.:

Std: 3.9037-3.9040″ (99.155-99.170mm)

PISTON/ROD INSPECTION

1. Measure piston pin bore.

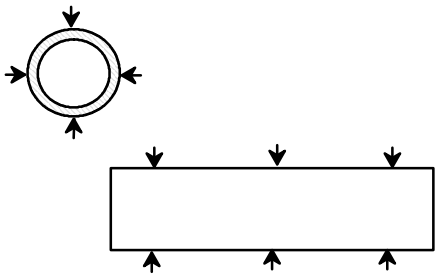


Piston Pin Bore

Piston Pin Bore:

.9055-.9057″ (23.001-23.007 mm)

2. Measure piston pin O.D. Replace piston and/or piston pin if out of tolerance.

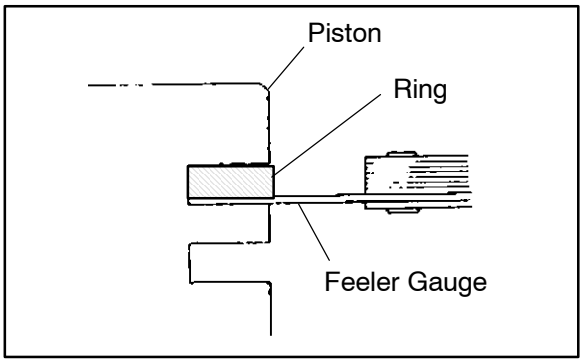


Piston Pin Measurement Locations

Piston Pin O.D.

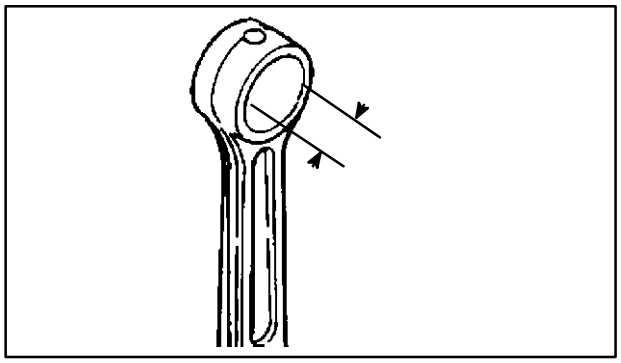
.9053-.9065″ (22.994-23 mm)

3. Measure piston ring to groove clearance by placing the ring in the ring land and measuring with a thickness gauge. Replace piston and rings if ring-to-groove clearance exceeds service limits.



Piston Ring-to-Groove Clearance
Top Ring Limit: .0059″ (.15 mm)
Second Ring Limit: .0059″ (.15 mm)

4. Measure connecting rod small end ID.

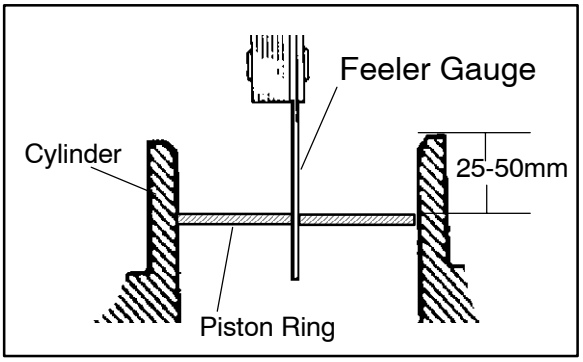


Small End I.D. :

Std: .9058-.9063″ (23.007-23.020 mm)

PISTON RING INSTALLED GAP

1. Place each piston ring inside cylinder using piston to push ring squarely into place.



Piston Ring Installed Gap

Top Ring
Std: .008-.012″ (.20-.30 mm)
Limit: .027″ (.7 mm)
Second Ring
Std: .014-.019″ (.35-.50 mm)
Limit: .031″ (.8 mm)
Oil Ring
Std: .004-.019″ (.10-.50 mm)
Limit: .039″ (1.0 mm)

2. Measure installed gap with a feeler gauge at both the top and bottom of the cylinder. **NOTE:** A difference in end gap indicates cylinder taper. The cylinder should be measured for excessive taper and out of round.
3. If the *bottom* installed gap measurement exceeds the service limit, replace the rings. If ring gap is below specified limit, file ring ends until the gap is within the specified range.

NOTE: Always check piston ring installed gap after re-boring a cylinder or when installing new rings. A re-bored cylinder should always be scrubbed thoroughly with hot soapy water, rinsed, and dried completely. Wipe cylinder bore with oil immediately to prevent rust.

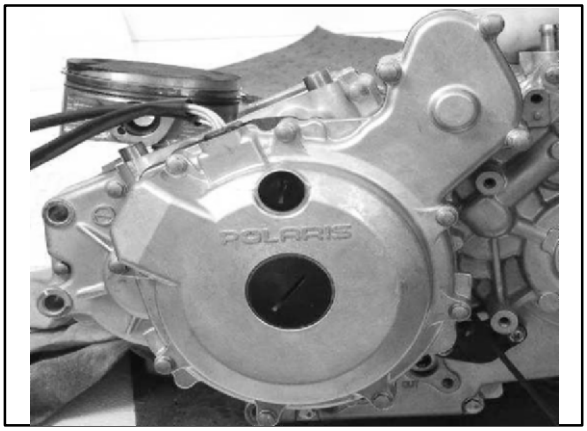
CRANKCASE DISASSEMBLY AND INSPECTION

NOTE: The starter motor, starter drive gears, flywheel, stator, cam chain and sprockets can be serviced with the engine in the frame.

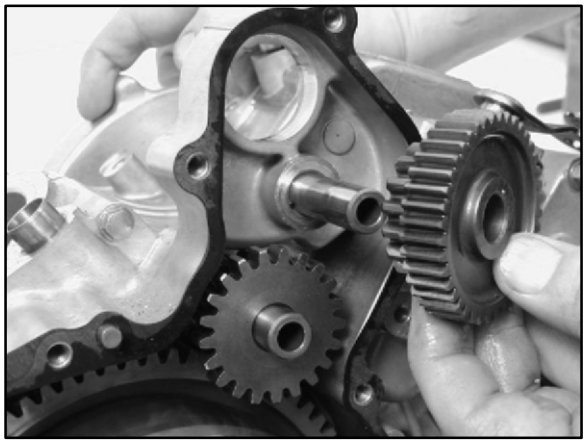
NOTE: Crankcase and transmission components cannot be serviced in the frame. Upper engine components, with the exception of the starter and stator removal, must be disassembled prior to performing these procedures.

STARTER DRIVE GEARS REMOVAL AND INSPECTION

1. Remove the starter.
2. Remove the 11 screws holding the stator cover assembly.

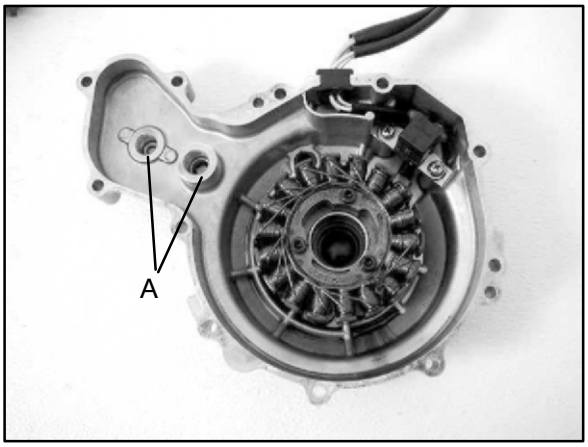


3. Inspect the drive gears and shafts for wear or damage and replace if necessary.



4. Measure the OD of the starter drive shafts on both ends and record. Measure in two directions 90° apart to determine if components are out of round. Replace if components are worn or damaged.

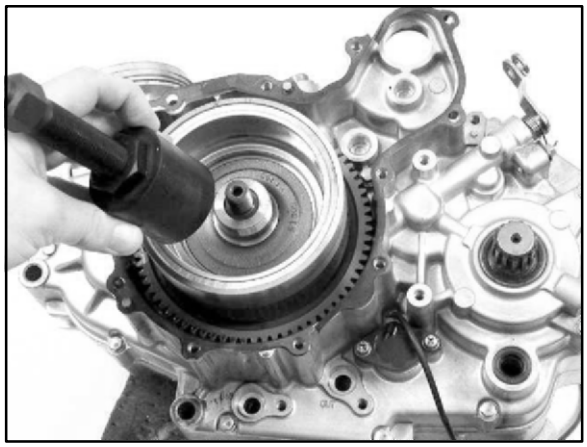
5. Measure the ID of the bushing in the stator housing (A) and the crankcase and record. Measure in two directions 90° apart to determine if cover is out of round. Replace cover if clearance is determined to be excessive.



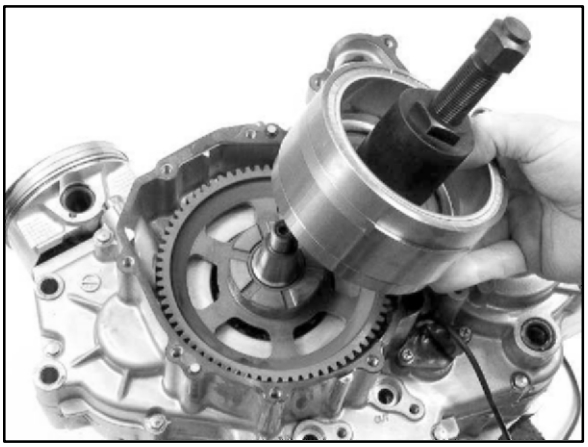
6. Inspect gear teeth on starter drive gears. Replace gears if gear teeth are cracked, worn, or broken.
7. **Installation:** Reverse the removal procedures and install with a new gasket. Do not use sealant. Torque the bolts in a criss-cross pattern to **80-97 Inch Lbs.(9-11 Nm)**.

FLYWHEEL AND ONE-WAY STARTER CLUTCH REMOVAL/INSPECTION

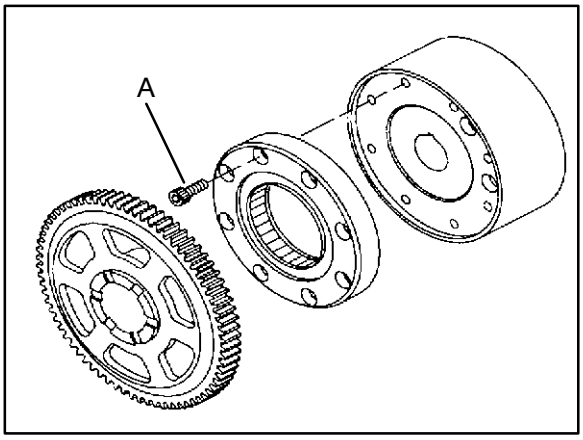
1. Remove flywheel nut and washer.
2. Install Flywheel Puller (**PA-46075**) and remove flywheel. **CAUTION:** Thread the puller onto the flywheel fully or flywheel threads may be damaged.



3. Removing the flywheel exposes the starter drive main gear and one way clutch, which is mounted on the flywheel. Inspect the main gear and bearing for wear, broken teeth or other damage. Inspect the one-way clutch for wear or damage to the rollers, springs, etc. Replace one-way assembly if excessive wear or damage is found.



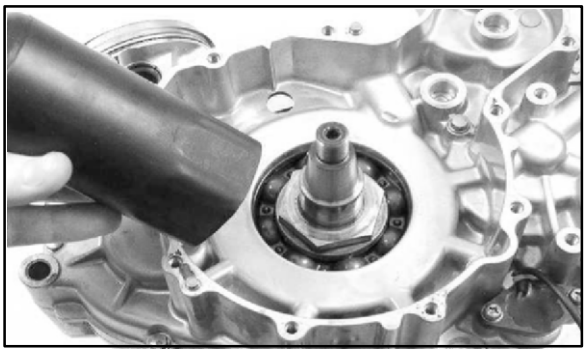
4. To replace the one-way starter clutch, remove the 8 screws holding the assembly to the flywheel (A). Reinstall the screws and torque to **155-133 Inch Lbs. (13-15 Nm)** in a criss-cross pattern.



5. **Installation:** For installation of flywheel and starter gears, reverse the removal procedures. When installing the flywheel, apply engine oil to the crankshaft threads and torque the flywheel nut to **111-125 Ft Lbs. (150-170 Nm)**.

CRANKSHAFT NUT REMOVAL

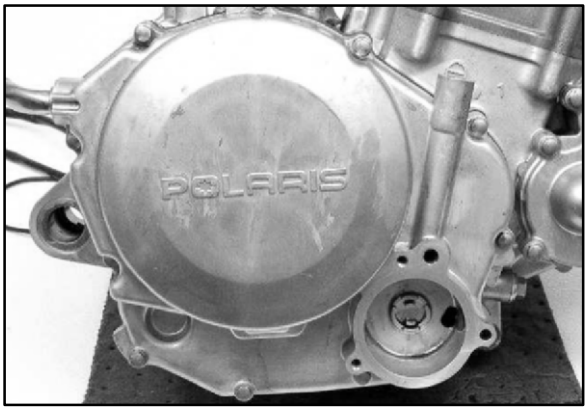
1. Remove the stator–side crankshaft nut using MAG End Crankshaft Nut Remover/Installer (**PN PA–46076**) while using a suitable holding fixture to keep the crankshaft from turning.



2. To reinstall, use a suitable holding fixture and MAG End Crankshaft Nut Remover/Installer (**PN PA–46076**) to torque the nut to **59-74 Ft Lbs. (80-100 Nm)**.

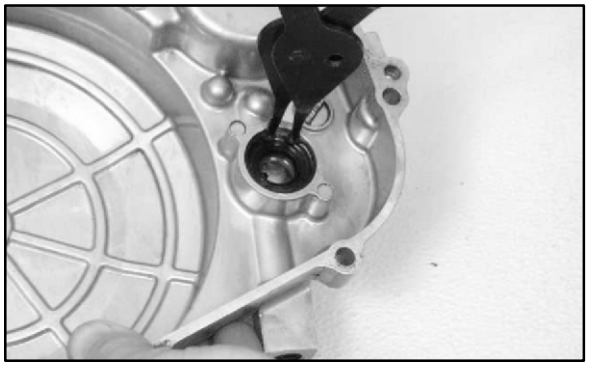
CLUTCH COVER / CLUTCH REMOVAL AND INSPECTION

1. Remove the 11 screws holding the clutch cover. NOTE: Oil filter cover has been previously removed.



2. Remove the gasket. Clean the gasket surfaces prior to reassembly.

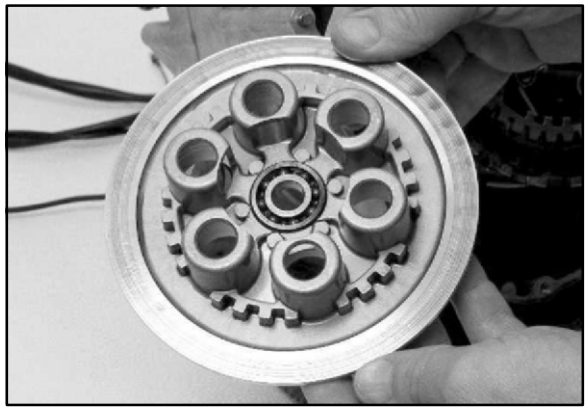
3. Inspect or replace the crankshaft oil seal anytime the clutch cover is removed for service. Install with the seal lip pointed in toward the cover.



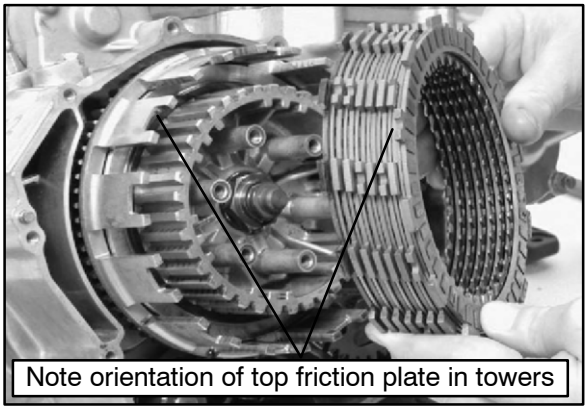
4. Remove the 6 screws holding the clutch pressure plate.

CAUTION: Assembly is under spring pressure. Wear safety glasses during removal.

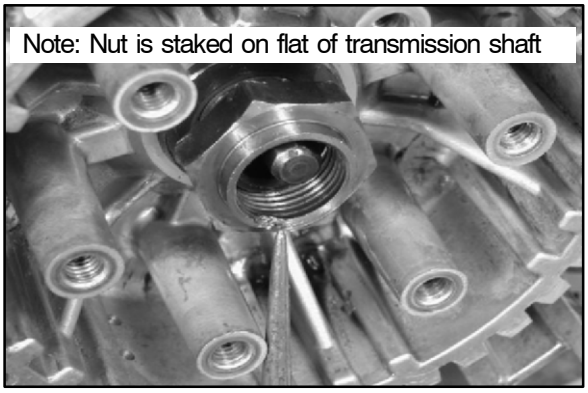
5. Remove and inspect the clutch pressure plate for wear, cracks, etc. Check bearing for wear and smooth rotation. Replace either component if found to be damaged or worn.



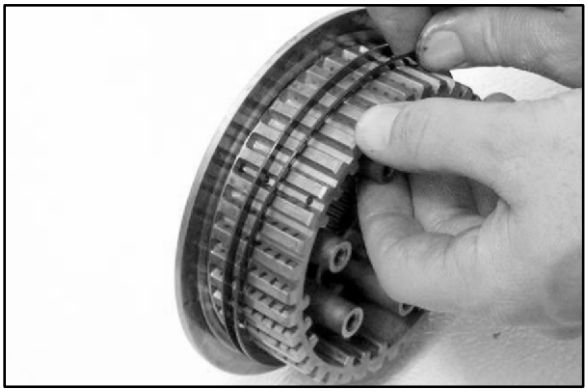
6. Remove the clutch plates and friction discs, keeping them in order. Inspect the pressure plates for wear and warpage. Inspect the friction plates for wear or damage to friction material. If either are damaged or worn excessively, replace the components as a set.
   NOTE: Removal of the clutch pack is not required to remove the clutch basket.


Note orientation of top friction plate in towers

7. To remove the clutch basket, remove the plunger from the center of the clutch and de-stake the nut to avoid damaging the threads upon removal.


Note: Nut is staked on flat of transmission shaft

8. Inspect the spring judders. Leave in place for reassembly if not damaged.

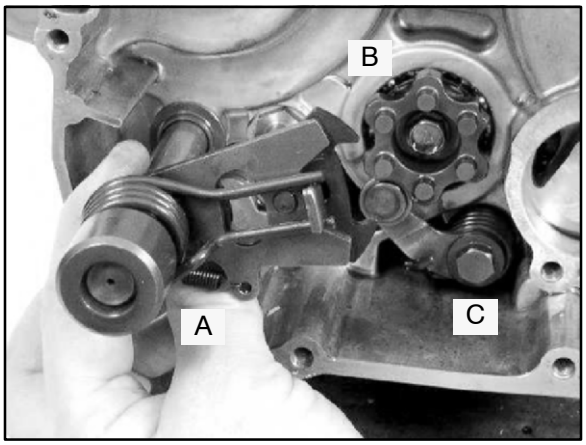


9. **Installation:** Reverse the procedures. Using a new nut, torque the clutch basket retaining nut to **66-81 Ft Lbs. (90-110 Nm)**. Stake the nut at the flat on the transmission shaft. Install the clutch plates in order of removal. Reinsert the plunger into the shaft. Reinstall the cover, pressure plate screws and springs. Torque the screws to **80-97 Inch Lbs.(9-11 Nm)**.

SHIFTER COMPONENT REMOVAL/ INSPECTION

1. With the clutch basket removed, remove the shift shaft assembly (A), shift cog (B), and shift detent spring assembly (C).

CAUTION: Shift detent (C) is under spring pressure. Use care during removal.

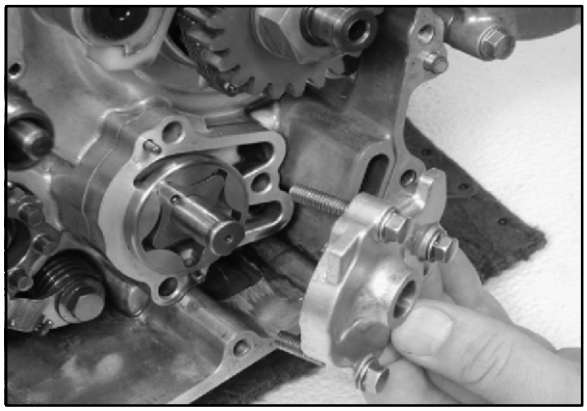


2. Inspect for wear or damage to shaft assembly and components, shift cog, detent assembly and springs. Replace if wear or damage is evident.
3. **Installation:** Reverse the procedures. Torque the shift cog retaining bolt (B) to **80-97 Inch Lbs.(9-11 Nm)** and the detent spring assembly bolt (C) to **80-97 Inch Lbs.(9-11 Nm)**.

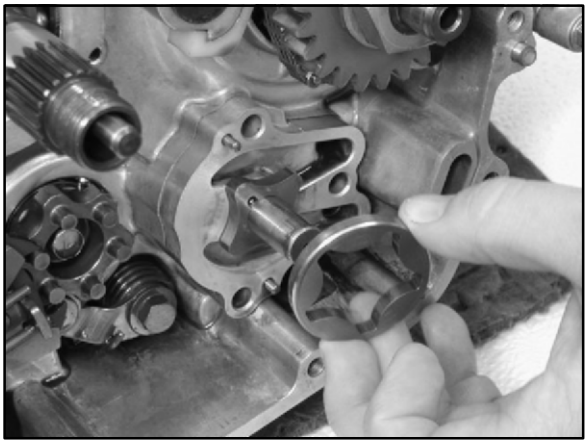
OIL PUMP REMOVAL and INSPECTION

1. Remove the circlip holding the oil pump gear and remove the gear.

2. Remove the 3 bolts holding the oil pump cover. Inspect the inside of the cover for wear or scoring.



3. Remove the outer pump rotor assembly. Inspect for signs of scoring or excess wear. **NOTE:** Cross pins for the pump rotors are loose and may become lost. Keep pins in a secure location.



4. Remove the inner pump chamber and pump rotor assembly. Inspect these components for wear or scoring. NOTE: Dowel pins for the inner pump body are loose and may become lost. Keep pins in a secure location.

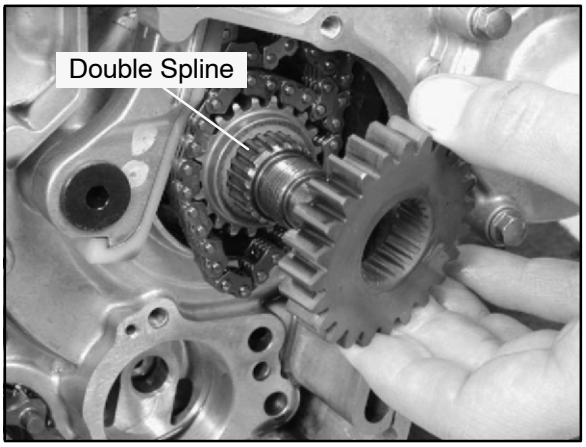
5. Replace any component that is found to be damaged or worn.

OIL PUMP CLEARANCE Limits are same as Standard			
Body	Feed/ Scavenge	.006-.008″	.15 - .21mm
Rotor Tip	Feed/ Scavenge	Less than .006″	Less than .15 mm
Rotor Side	Feed	.0007-.003″	.02 - .08mm
	Scavenge	.002-.006″	.05 - .16mm

6. **Installation:** Reverse the procedures. Use assembly lube or clean engine oil to coat the parts before assembly. Tighten the cover bolts to **80-97 Inch Lbs.(9-11 Nm)**. Verify the pump turns freely during and after torqueing bolts.

CRANKSHAFT DRIVE AND CAM GEAR REMOVAL

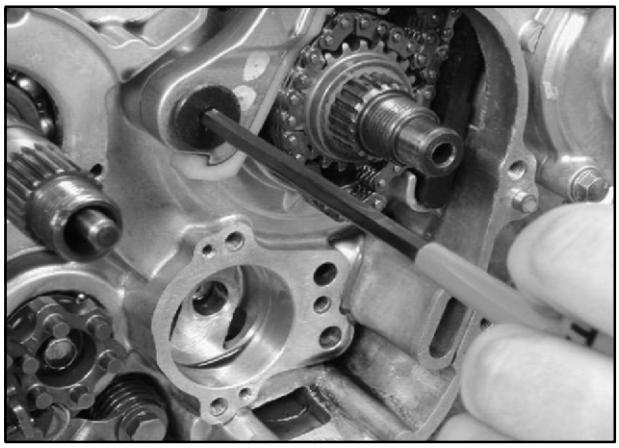
1. Remove the crankshaft nut, washer and drive gear. ***Note and white-mark the double spline on both gears and shaft for ease of reassembly.***



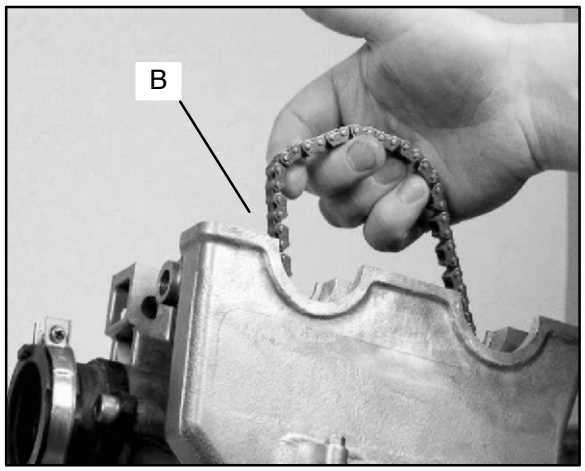
2. Remove the cam gear and thrustwasher from the crankshaft for inspection. Replace if damage or excessive wear is present to the gear teeth or splines.
3. **Installation:** Reverse the procedures and torque nut to **59-74 Ft Lbs.(80-100 Nm)**.

CAM CHAIN/TENSIONER BLADE REMOVAL

1. Remove bolt securing tensioner pivot blade to crankcase (A).



2. Remove the blade and inspect for cracks, wear, or damage.
3. Remove cam chain (B). Inspect chain for worn or missing rollers or damage. Stretch chain tight on a flat surface and apply a 10 lb. (4.53 kg) load. Measure length of a 20 pitch section of chain. Replace if worn past service limit.

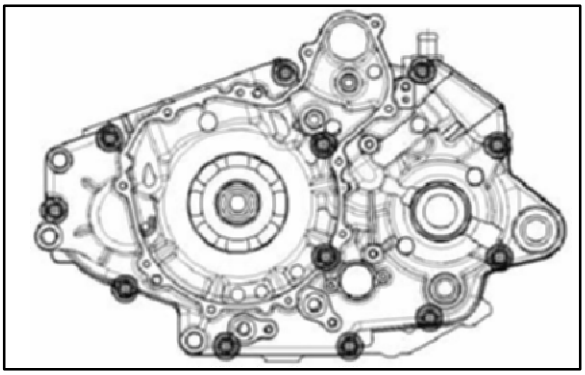


Chain Service Limit:
5.407″ (13.7 cm)

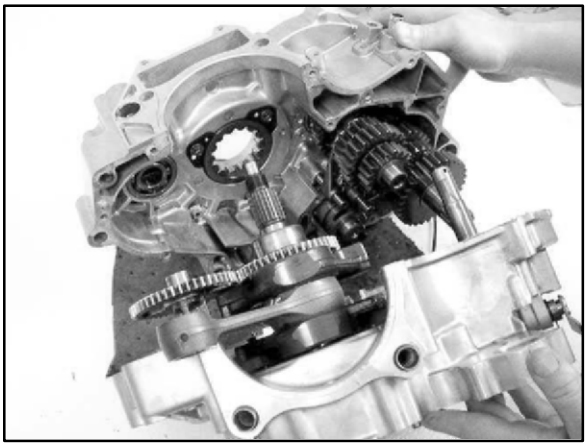
4. **Installation:** Reverse the procedures and torque the pivot blade bolt to **10-12.2 Ft Lbs.(13.5-16.5 Nm)**.
5. See Page 3.38 for Cam Timing.

CRANKCASE SEPARATION

1. Remove flange bolts (12) from magneto side crankcase evenly in a criss-cross pattern.



2. Separate crankcase by tapping with a soft faced hammer in reinforced areas.
3. Watch the gap along the crankcase mating surface, making sure to separate the crankcase evenly. It may also be necessary to tap the clutch side of the crankshaft lightly to help separate the crankcase.



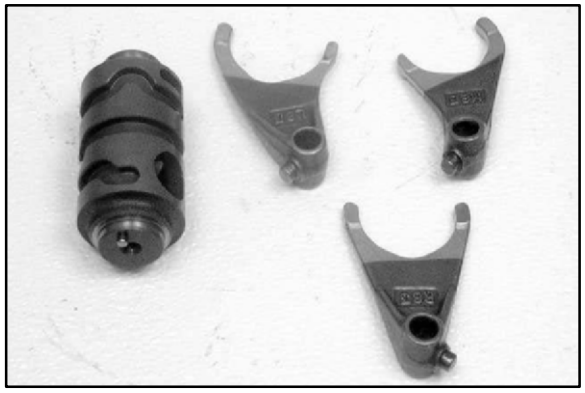
4. Once the crankcase halves are split apart, orientate the components into the stator side of the crankcase containing the crankshaft, balancer, oil tube, the transmission gears and shift components for ease of reassembly. The crankshaft is designed to slip out of the pto side upon disassembly.

CRANKCASE INSPECTION

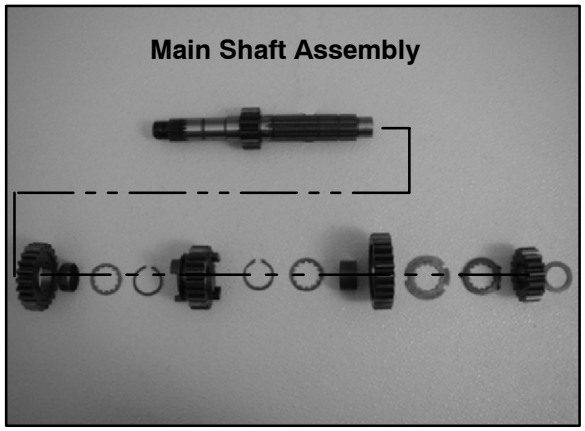
1. Remove all traces of gasket sealer from the crankcase mating surfaces. Inspect the surfaces closely for nicks, burrs or damage.
2. Check the oil pump and oil passage mating surfaces to be sure they are clean and not damaged. Verify the oil pump screen is clean.

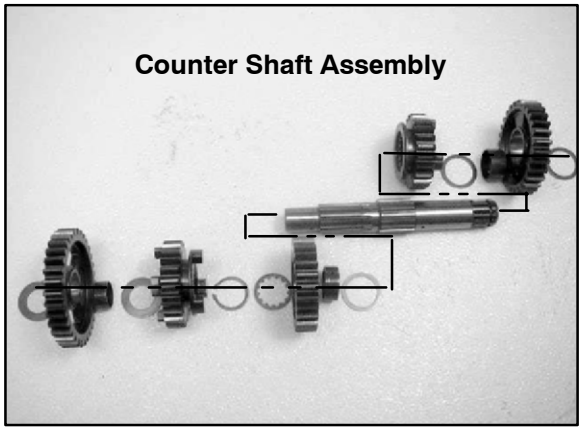
TRANSMISSION REMOVAL/INSPECTION

1. Remove the shift forks, shift fork tubes and shift drum from the transmission assembly.



2. Remove the main and counter transmission shaft assemblies and disassemble, keeping the parts removed in order for ease of reassembly. Inspect the shift forks, shift drum, shift dogs, gear teeth and shaft splines for damage. Their edges should be square and sharp. If any components are found to be rounded, worn, or otherwise damaged, they must be replaced.



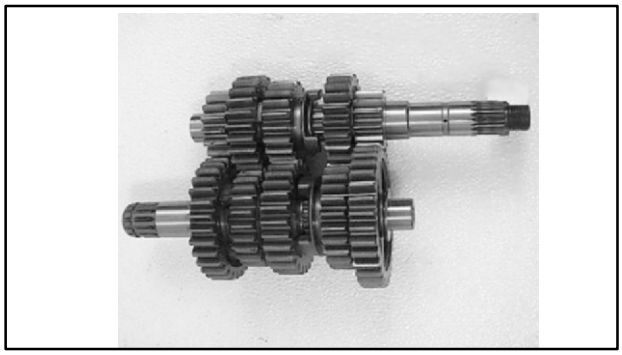


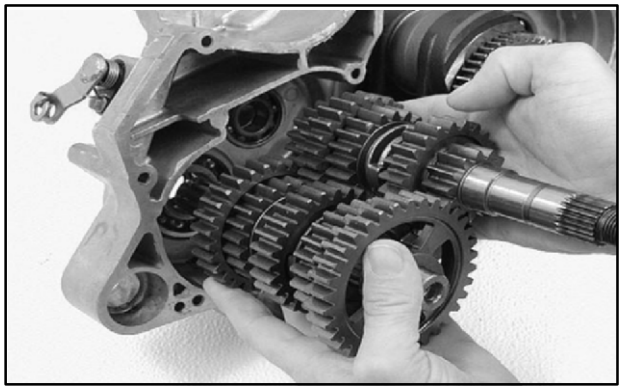
3. Inspect the shaft support bearings in the crankcase halves. Replace if any roughness or wear is felt. See page 3.33 for crankcase bearing inspection/removal.
4. To reassemble, reverse the procedures using the following photos for reference.

Transmission Reassembly:

NOTE: Shift forks are sized to fit the shift dogs. Do not attempt to force. Test fit all pieces for familiarity before assembly.

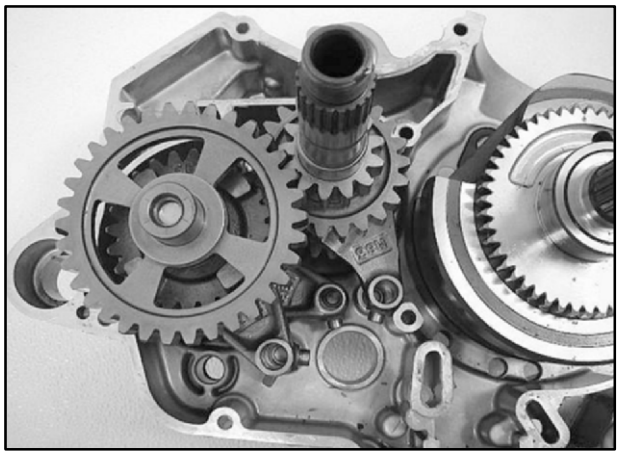
1. Join and insert the counter shaft assembly, main shaft assembly and “L” shift fork (face up) into the stator side casehalve. Do not insert shift fork pins at this time.





NOTE: Do not to allow transmission parts to fall from their assemblies during installation. Parts that are out of alignment will cause improper casehalve mating, resulting in transmission binding. Use of assembly lube to “stick” parts together for ease of installation is recommended.

2. Insert the “M” and R” shift forks (face up).



3. Insert and rotate the shift drum to align the loctating pin at approximately the 1 o’clock position. Align the “L” shift fork first, then align the other shift forks into the shift drum, installing each shift fork pin as they are assembled. NOTE: lifting of fork and gear will be required to install into shift drum.

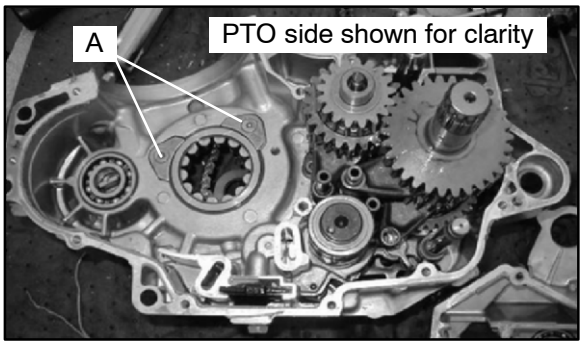
4. Rotate the assembly, checking for gear binding and fit.

CRANKSHAFT REMOVAL/INSTALLATION

To remove crankshaft:

1. Remove the crankshaft retaining nut using MAG End Crankshaft Nut Remover/Installer (**PA-46076**).

2. Remove the crankshaft bearing retainer screws using a impact driver. (A). **NOTE:** ***Screw threads contain locking agent. Heating of screws is required for removal. Use caution and wear the proper safety equipment while performing this procedure.***

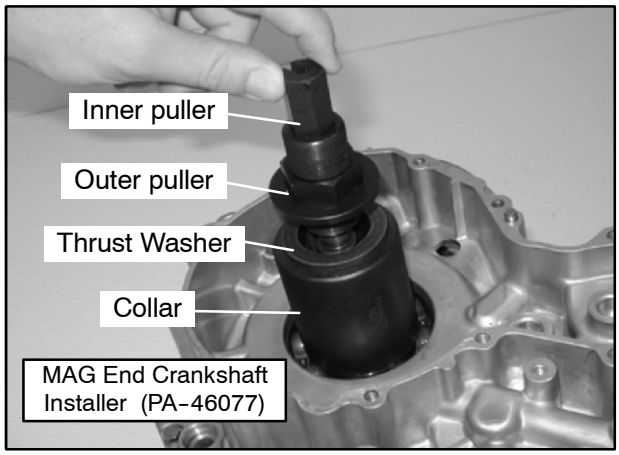


3. Support the stator side crankcase in a stand to press the crankshaft out. Use care not to damage the crankcase mating surface or connecting rod. Applying heat to the crankcase bearing area to ease removal is acceptable.
4. Attach Crankcase Separator (**PA-46087**) to the casehalve. Turn the inner shaft clockwise while holding the outer shaft to press the crankshaft and bearing as an assembly out of the case.

To install crankshaft:

5. Press the bearing into the crankcase at the outer edges with an appropriate driver. Insert the bearing retainers and **new** screws, which have a pre-applied locking agent. Torque the screws to **8.1-9.6 Ft Lbs.(11-13 Nm)**.

6. Using MAG End Crankshaft Installer **(PA-46077)**, draw the crankshaft into the bearing assembly by sliding the collar and thrustwasher over the crankshaft end, threading the inner puller onto the crankshaft end. Turn the outer nut clockwise while holding the inner to pull the crankshaft into the bearing.

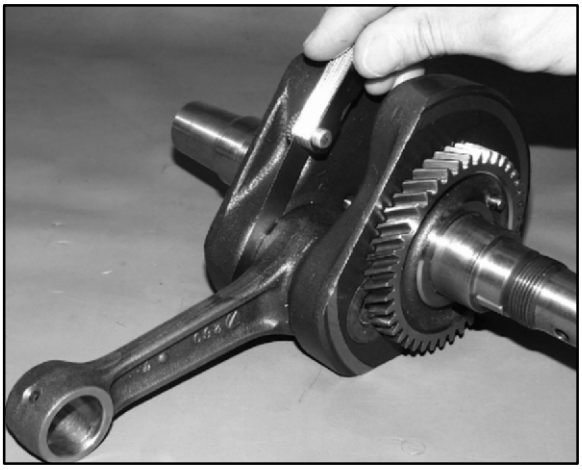


CRANKSHAFT INSPECTION

NOTE: Larger than standard readings indicate excessive wear.

NOTE: Crankshaft components are press-fit and are serviceable. Refer to the crankshaft rebuilding manual and parts manual for rebuild information.

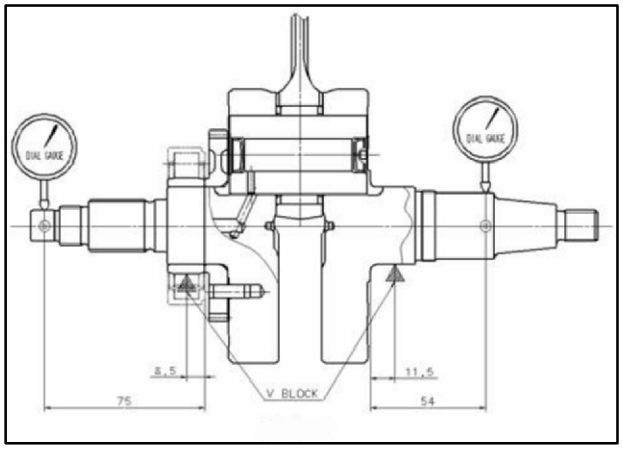
1. Inspect the crankshaft connecting rod bearing journal for scoring and abnormal wear.
2. Use a feeler gauge to measure the connecting rod big end side clearance.



Connecting Rod Big End Side Clearance:

Limit: .0256″ (.65 mm)

3. Place the crankshaft in a truing stand or V-blocks and measure the runout on both ends with a dial indicator. See Crankshaft Straightening on Page 3.9.



Max Runout: .0012″ (.03 mm)

4. Measure the connecting rod big end radial clearance.

Big End Radial Clearance:

Limit: .0004-.0015″ (.011-.038 mm)

5. Measure the connecting rod small end radial clearance.

Small End Radial Clearance:

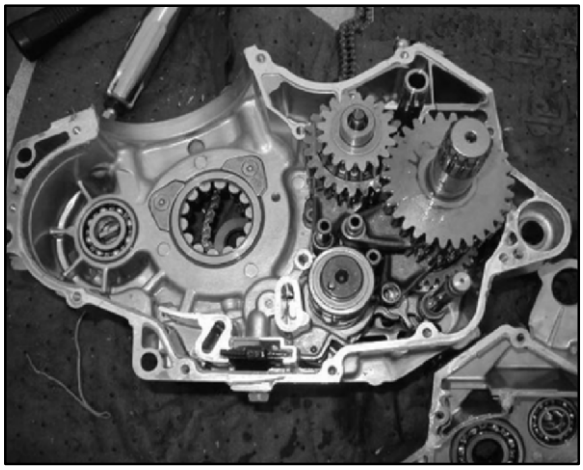
Limit: .0020″ (.05 mm)

6. Measure the connecting rod small end I.D.

Small End I.D. :

Std: .9058-.9063″ (23.007-23.020 mm)

CRANKCASE BEARING INSPECTION/REMOVAL/ INSTALLATION



1. Inspect the crankshaft main bearings, balancer shaft bearings, output shaft and pump shaft bearings.

NOTE: Due to extremely close tolerances and minimal wear, the bearings must be inspected visually, and by feel. Look for signs of discoloration, scoring or galling. Turn the inner race of each bearing. The bearings should turn smoothly and quietly. The outer race of each bearing should fit tightly in the crankcase. The inner race should be firm with minimal side to side movement and no detectable up and down movement.

Bearing Removal:

NOTE: To ease bearing removal, warm the bearing area, but not the bearing itself, until hot to the touch to expand the bearing cavity. Wear the appropriate safety equipment during the heating and removal process.

1. Support the crankcase and drive or press the main bearings out of each crankcase.
2. To remove balancer shaft bearings and pump shaft bearing, use a blind-hole bearing puller.

NOTE: Bearings are stressed during the removal process and *should not* be re-used!

Bearing Installation:

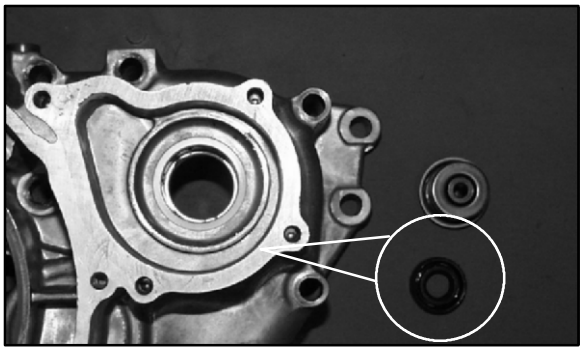
NOTE: For ease of bearing installation, warm the crankcase until hot to the touch to expand the bearing cavity. Place the bearings in a freezer. This shrinks the bearing outer diameter slightly. Wear the appropriate safety equipment during the heating and installation process.

1. Install the bearings so the numbers are visible.
2. Drive or press new bearings into the crankcases, using the proper driver. **CAUTION:** Press only on outer race of bearing to prevent bearing damage.

PUMP SHAFT OIL SEAL/ WATER PUMP MECHANICAL SEAL REMOVAL (ENGINE DISASSEMBLED)

NOTE: The water pump mechanical seal can be removed without removing the engine. Refer to Water Pump Mechanical Seal Installation.

Replace the water pump mechanical seal whenever the crankcase is disassembled.



1. Remove the pump shaft bearings from the pto (right hand) side crankcase.
2. Drive the water pump mechanical seal out of the crankcase from inside to outside. NOTE: The new mechanical seal must be installed after the crankcases are assembled, using special tools. See Mechanical Seal Installation.

WATER PUMP MECHANICAL SEAL INSTALLATION

1. Clean the seal cavity to remove all traces of old sealer.
2. Place a new mechanical seal in the seal drive collar, and install on the pump shaft.
3. Screw the guide onto the end of the pump shaft.
4. Install the washer and nut and tighten to draw seal into place until fully seated.
5. Remove the guide adaptor using the additional nut as a jam nut if necessary.

WATER PUMP MECHANICAL SEAL REMOVAL

Water Pump Mechanical Seal Puller: (PN 2872105)

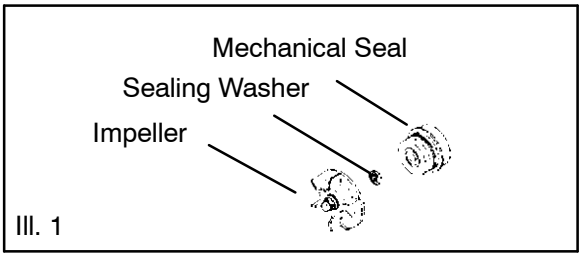
Replacement T-Handle: (PN 2872106)

CAUTION:

Improper or careless use of this tool or procedure can result in a bent water pump shaft. Pump shaft replacement requires engine removal and crankcase separation. Use caution while performing this procedure. Make sure that the puller is parallel to the shaft at all times. Do not place side loads on the water pump shaft or strike the puller or shaft in any way.

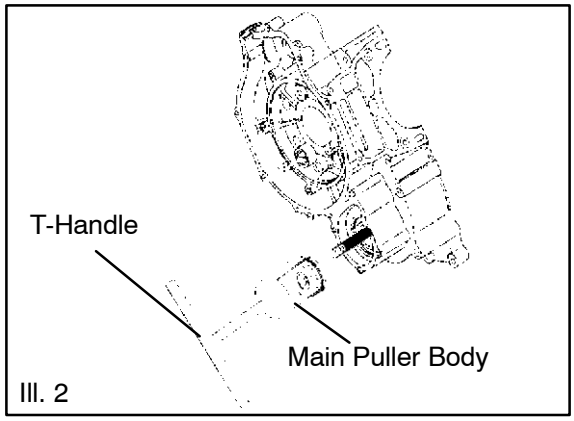
The Water Pump Mechanical Seal Puller allows a technician to replace the seal on ES50PL engines without removing the engine and splitting the cases. NOTE: This removal process dismantles the seal, making it unusable for reinstallation.

1. After the coolant has been drained, remove the water pump cover, impeller and the sealing washer. (Ill. 1)



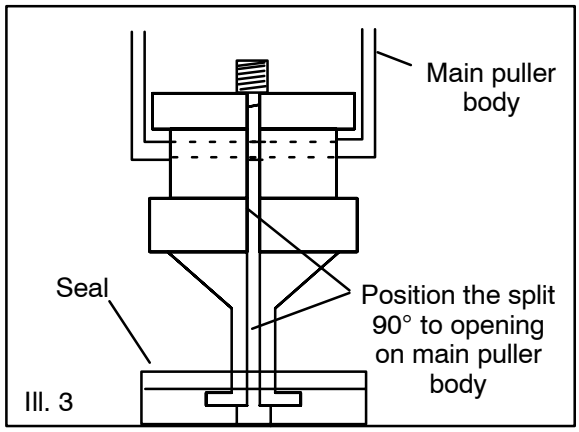
Ill. 1

2. Slide the main puller body over the outer portion of the mechanical seal as shown in Ill. 2 and turn T-Handle clockwise until it contacts water pump shaft. Continue rotating until outer portion of mechanical seal is separated from the metal seal body.



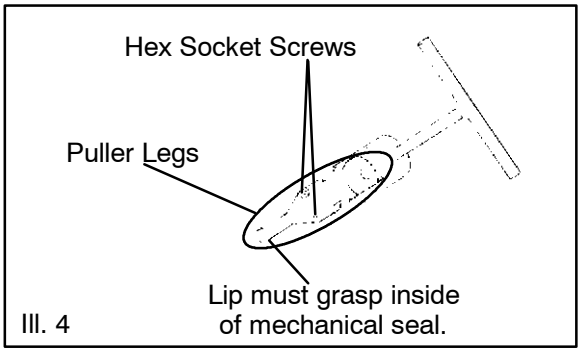
Ill. 2

3. Insert the puller legs between the water pump drive shaft and the remaining portion of the mechanical seal. Attach the puller legs to the main puller body. (Ill. 3)



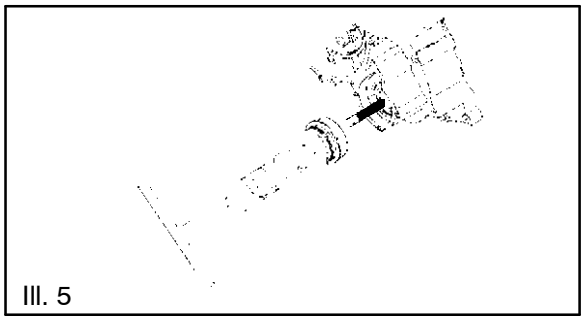
Ill. 3

4. Ensure that the split between the puller legs are fully supported by the main body of the tool (Ill 3).
5. Tighten the hex socket screws on the puller legs sufficiently so the lip of the puller legs will grasp the mechanical seal. Ill. 4



Ill. 4

6. Turn the puller T-Handle clockwise until it contacts the water pump shaft. Continue rotating until the remaining portion of mechanical seal has been removed from the cases. (Ill. 5).

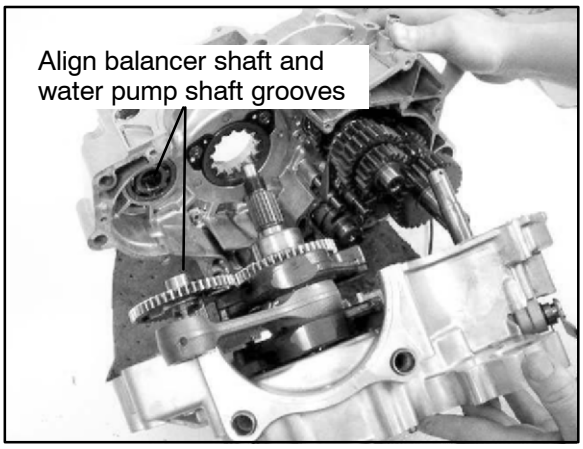


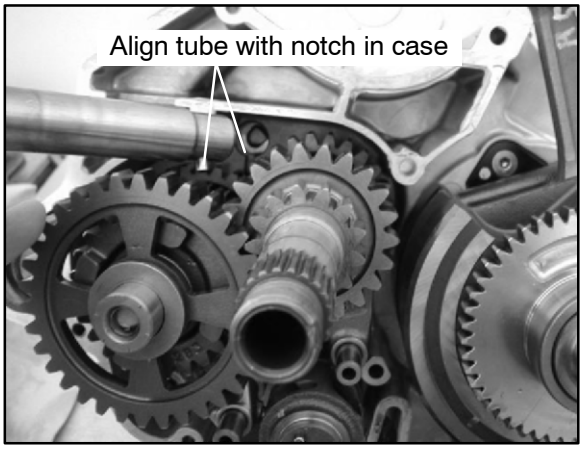
Ill. 5

7. The Water Pump Install Kit (**PN 5131135**) is required to install the new mechanical seal. This tool is available separately and it is also included in the Crankshaft/Water Pump Seal Installation Kit (**PN 2871283**).
8. Install the bottom rail with the gap at least 30° from the end of the expander on the side opposite the top rail gap.(See Ill. 1).
9. Install the second ring with the "R" mark facing up. Position the end gap toward the rear (intake) side of the piston.

CRANKCASE REASSEMBLY

1. After reinstalling the crankshaft, balancer, oil tube and transmission assembly into the stator case halve, apply a thin layer of Crankcase Sealer (**PN 2871557**) to all sealing surfaces of the pto half, being careful not to over apply, as excessive sealant may clog oil passages or drip into the crankcase. Allow the sealer to set for a few minutes before assembling the two halves together.
2. Reassemble the crankcase halves. This is best accomplished with the stator side casehalve settled in a suitable fixture that allows the casehalve to lay flat. This allows easier installation without parts falling out of position. Make sure the oil galley tube is oriented correctly and the balancer shaft groove aligns with the water pump shaft. Refer to photos. NOTE: some light tapping with a soft faced mallet may be required to bring the casehalves together.





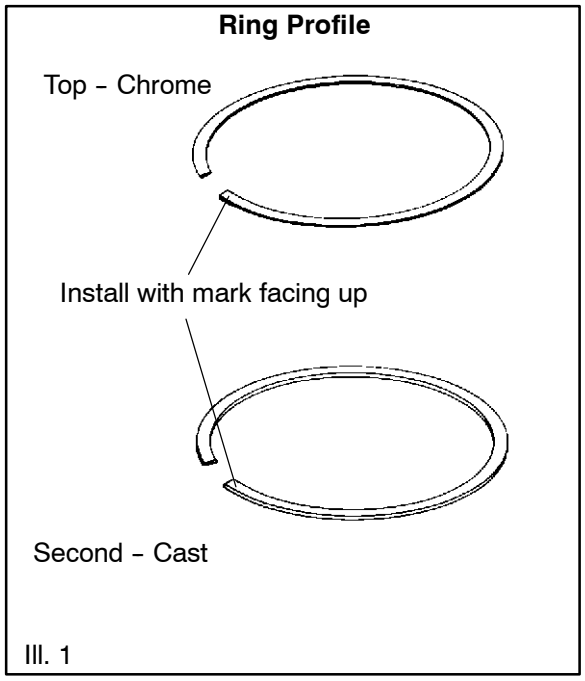
3. Reinstall the (12) flange bolts and tighten in a criss-cross pattern. Stop occasionally and check that all rotating assemblies turn freely. Torque the flange bolts to **80-97 Inch Lbs.(9-11 Nm)**.

PISTON RING INSTALLATION

NOTE: Apply clean engine oil to all ring surfaces and ring lands. Always check piston ring installed gap before rings are installed on piston. Refer to Page 3.24. If the piston has been in service, clean any accumulated carbon from the ring grooves and oil control ring holes.

1. Place the oil control ring expander in oil ring groove with the end gap facing forward. The expander has no up or down marking and can be installed either way. The ends should butt squarely together and must not overlap. Install the bottom and top rails.
2. Install the second ring with the mark facing up.
3. Install the top ring with the mark facing up (Ill 1).

4. Check to make sure the rings rotate freely in the groove when compressed

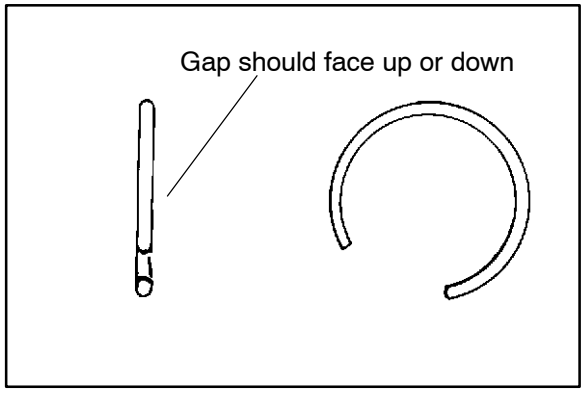


Ill. 1

5. Orientate the rings for installation by rotating until the end–gaps are 120 degrees apart.

PISTON INSTALLATION

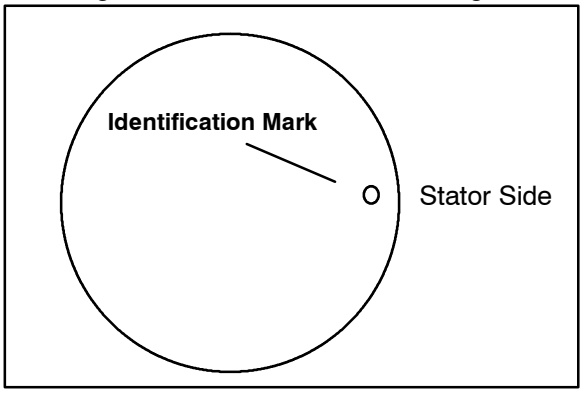
1. Clean the gasket surfaces on the cylinder and crankcase. Remove all traces of old gasket material.
2. Make sure the cylinder mounting bolt holes are clean and free of debris.



3. Install a new circlip on one side of the piston with the end gap facing *up* or *down*.

CAUTION: Circlips become deformed during the removal process. Do not re-use old circlips. Do not compress the new clip more than necessary upon installation to prevent loss of radial tension. Severe engine damage may result if circlips are re-used or deformed during installation.

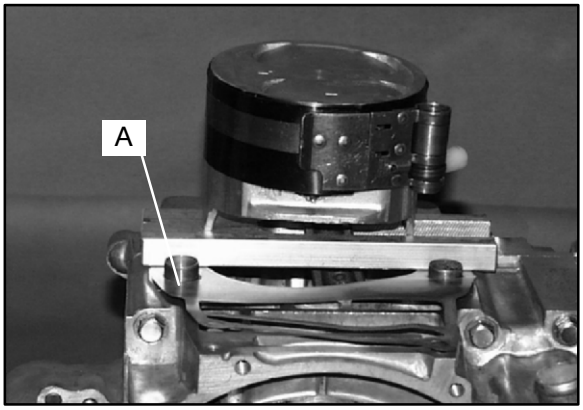
4. Apply clean engine oil to the piston rings, ring lands, piston pin bore, piston pin, and piston skirt. Lubricate the connecting rod (both ends), balancer drive gear, and crankshaft main bearing area.



5. Install the piston on the connecting rod with the identification mark facing the stator (RH) end of the crankshaft. The piston pin should be a push fit in the piston.
6. Install the other circlip with the gap facing up or down. (See Caution with Step 3 above). Push the piston pin in both directions to make sure the clips are properly seated in the groove.

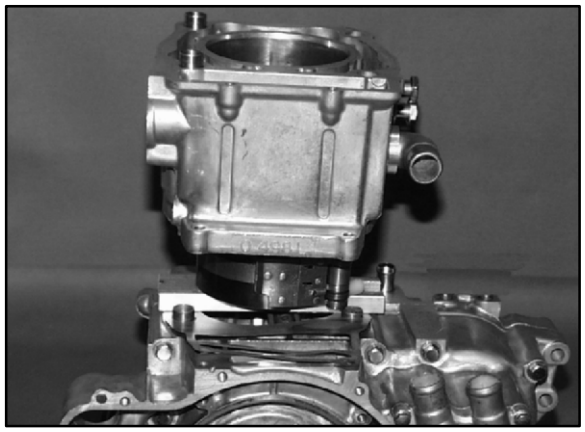
CYLINDER INSTALLATION

1. Place the dowel pins in the crankcase and install a new cylinder base gasket.

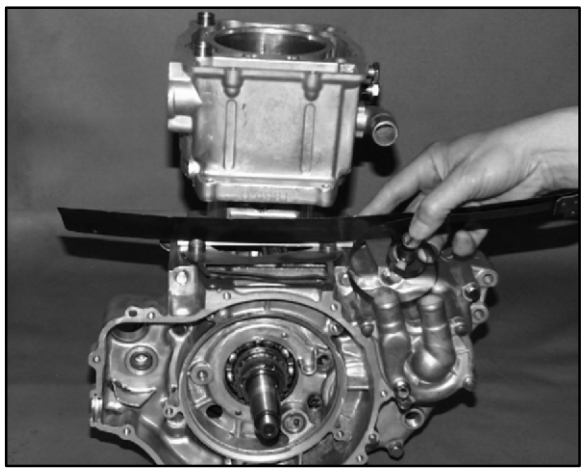


2. Position the Piston Support Block (**PN 2870390**) (A) beneath the piston skirt to support the piston during cylinder installation.

3. Apply clean engine oil to the ring compressor and install the compressor according to the manufacturers instructions. **CAUTION:** Verify all ring end gaps are correctly located.



4. Apply clean engine oil liberally to the cylinder bore and tapered area of the sleeve. Install the cylinder with a slight rocking motion until the rings are captive in the sleeve.



5. Remove the ring compressor and support block.
6. Push the cylinder downward until fully seated on the base gasket.
7. Rotate the engine and position the piston at BDC.

NOTE: If cam chain is installed, hold it up while rotating the engine to avoid damage to the chain, drive sprocket teeth, or tensioner blade.

CYLINDER HEAD INSTALLATION

Clean the gasket surfaces on the cylinder head and cylinder. Remove all traces of old gasket material. Refer to disassembly photos.

1. Install the cam chain tensioner guides. Be sure bottom end of guide is located properly in crankcase.
2. Install the two dowels and a new cylinder head gasket.
3. Place the cylinder head on the cylinder. Apply a film of engine oil to the cylinder head bolt threads and washers, and hand tighten the bolts.

The following procedure must be used to torque the cylinder head properly:

****TORQUE ALL BOLTS EVENLY IN A CRISS-CROSS PATTERN**

1 - Torque bolts to 22 ft. lbs. (30 Nm)

2 - Torque bolts to 51 ft. lbs. (70 Nm)

Leave at this torque for 1 minute to allow gaskets to seat for proper sealing.

3 - Loosen bolts evenly 360° (1 turn)

4 - Torque bolts to 29 ft. lbs. (35 Nm)

5 - From this point, tighten bolts evenly 90° (1/4 turn)

6 - Finally, tighten another 90° (1/4 turn)

7 - Install two 6mm bolts and torque to 6 ft. lbs. (8 Nm)

4. Install the two 6 mm bolts and torque to specification.

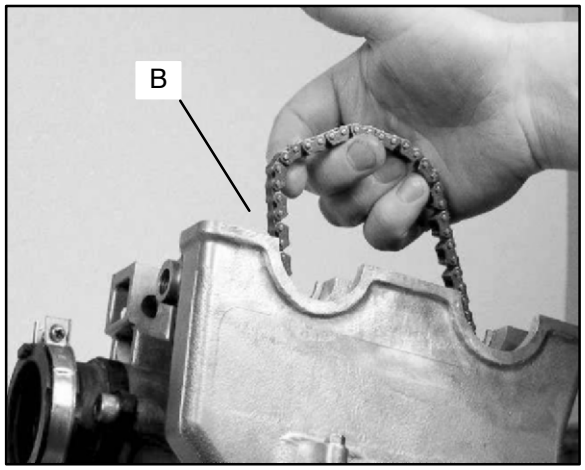
Cylinder 6mm Bolt Torque:

6 ft. lbs. (8 Nm)

CAM CHAIN INSTALLATION

NOTE: The camshafts, crankshaft sprocket and clutch basket must be removed to perform this procedure.

1. Install the cam chain by dropping it down through the chain room and over the crankshaft sprocket.



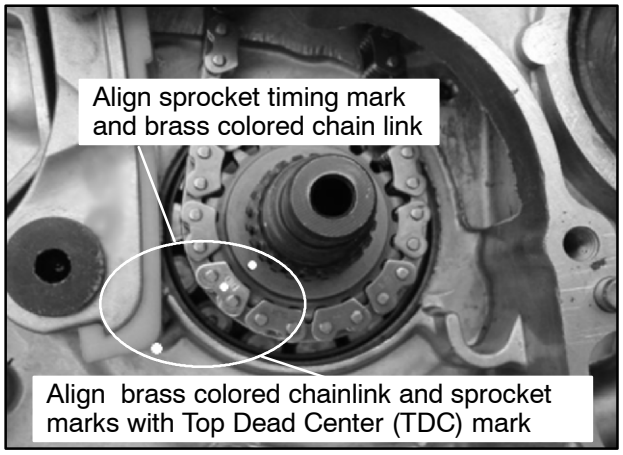
2. Use a suitable device to hold the chain in place to keep it from dropping through the chain room, such as wire or a hammer handle.

CAMSHAFT TIMING

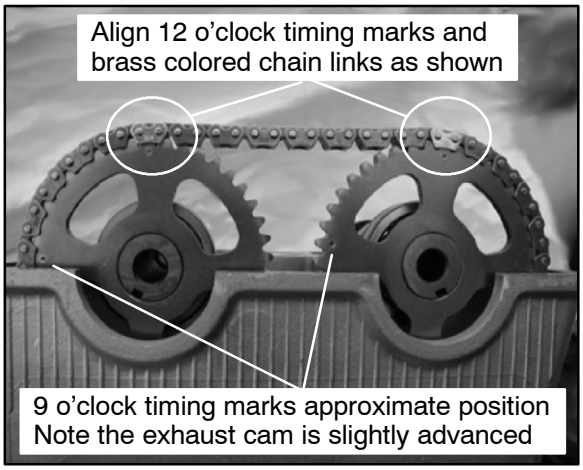
CAUTION: Serious engine damage will result if the camshaft is not properly timed to the crankshaft.

IMPORTANT CAMSHAFT TIMING NOTE: The Top Dead Center (TDC) mark is used to time the camshaft to the crankshaft. Follow the procedures outlined. Refer to the diagram on Page 3.40.

1. Apply engine oil or assembly lube to the camshaft main journals, cam lobes and the automatic compression release mechanism.
2. Place the thrust washer onto the crankshaft with the chamfered side inward. Install the crankshaft cam sprocket onto the shaft. Note the double spline for ease of installation. The alignment mark should face outward.
3. If not already at Top Dead Center, Loosely hold the cam chain and rotate the crankshaft until the crankshaft cam sprocket timing mark is aligned with the Top Dead Center (TDC) mark on the crankcase (see photo). Position the chain for correct timing by aligning the bottom cam timing mark with the brass colored bottom chain link. Keep tension on the chain so as to not lose chain alignment at the crankshaft sprocket during cam installation.



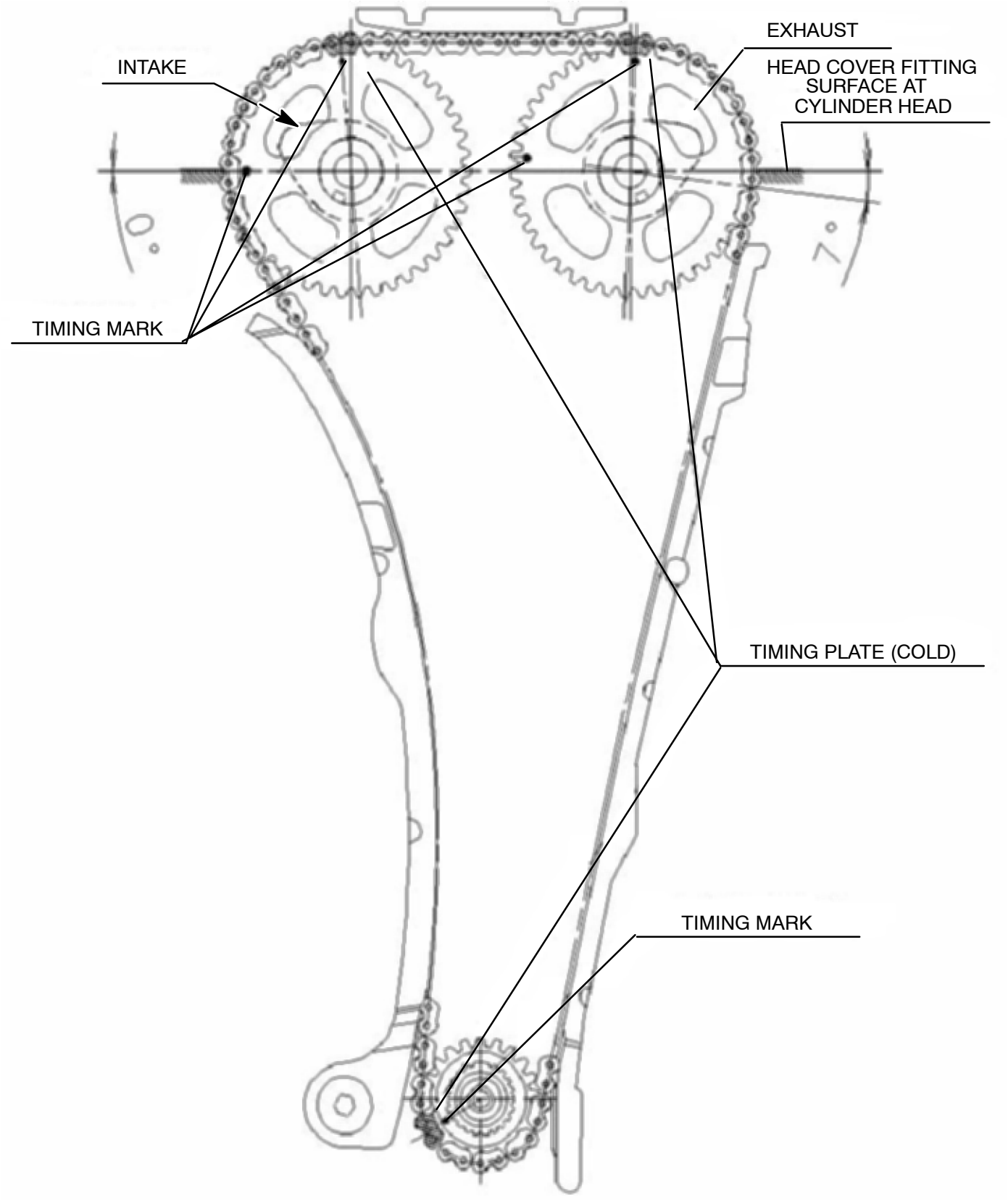
4. Install the camshafts one at a time. First, install the exhaust cam by looping the chain over the cam gear. At the same time, position the cam chain for correct timing by aligning the brass colored chain link with the 12 o'clock dot on the cam sprocket. The sprocket secondary mark should be at the 9 o'clock position. *Keep tension on the chain so as to not lose chain alignment at the crankshaft sprocket.*
5. Next, install the intake cam, positioning the upper cam chain for correct timing by aligning the remaining brass colored chain link with the 12 o'clock dot on the cam sprocket. Timing is in phase when all three brass colored cam chain links align with all three sprocket timing marks and the secondary cam gear marks are at approximately the 9 o'clock position, with the exhaust cam timing mark slightly advanced. Refer to the diagram on Page 3.40
   NOTE: *Failure to align marks in this fashion will cause valve-to-piston interference, resulting in engine damage*



6. Re-check all cam timing marks to verify proper cam timing, and install the cam tower. Tighten the bolts evenly in a criss-cross pattern to specification. ***Do not rotate engine until the tensioner has been installed to avoid chain slip and loss of timing reference.***
7. Install the tensioner assembly. (Refer to Pg 3.13-3.14). Verify timing by rotating the crankshaft two full revolutions (720 degrees), checking for valve-to-piston interference which would indicate a problem with cam timing. If interference is noted, immediately stop rotation and reverify cam timing.
   NOTE: *Rotating the engine during verification will cause the timing alignment marks to rotate out of phase, and will take as many as 20 revolutions to come back into phase. To maintain alignment of the marks if needed, rotate the engine backward the same number of turns as forward.*
8. With timing procedure completed, install the primary drive sprocket, washer and nut onto the crankshaft. Torque to specification.

PRIMARY DRIVE GEAR INSTALLATION

1. Install the thrustwasher chamfered side inward, the cam sprocket with algnment mark outward.
2. With chain in place and cam timing having been performed, install the primary drive sprocket, washer and nut onto the crankshaft. Torque to **59-74 ft lbs (80-100 Nm)**.


EXHAUST
INTAKE
HEAD COVER FITTING SURFACE AT CYLINDER HEAD
0°
7°
TIMING MARK
TIMING PLATE (COLD)
TIMING MARK

CYLINDER HONE SELECTION AND HONING PROCEDURE

CAUTION:

A hone which will straighten as well as remove material from the cylinder is very important. Using a common spring loaded glaze breaker for honing is not advised for nicasil cylinders. Polaris recommends using a rigid hone or arbor honing machine.

Cylinders may be wet or dry honed depending upon the hone manufacturer's recommendations. Wet honing removes more material faster and leaves a more distinct pattern in the bore.

IMPORTANT: Clean the Cylinder After Honing

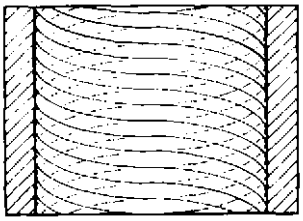
It is very important that the cylinder be thoroughly cleaned after honing to remove all grit material. Wash the cylinder in a solvent, then in hot, soapy water. Use electrical contact cleaner if necessary to clean these areas. Rinse thoroughly, dry with compressed air, and oil the bore immediately with Polaris 4 Cycle Lubricant to prevent the formation of surface rust.

HONING TO DEGLAZE

A finished cylinder should have a cross-hatch pattern to ensure piston ring seating and to aid in the retention of the fuel/oil mixture during initial break in. Hone cylinder according to hone manufacturer's instructions, or these guidelines:

- Use a motor speed of approximately 300-500 RPM, run the hone in and out of the cylinder rapidly until cutting tension decreases. Remember to keep the hone drive shaft centered (or cylinder centered on arbor) and to bring the stones approximately 1/2″ (1.3 cm) above and below the bore at the end of each stroke.
- Release the hone at regular intervals and inspect the bore to determine if it has been sufficiently deglazed, and to check for correct cross-hatch. **NOTE**: **Do not allow cylinder to heat up during honing**.
- After honing has been completed, inspect cylinder for thinning or peeling.

If cylinder wear or damage is excessive, it will be necessary to replace the cylinder. Hone only enough to deglaze the outer layer of the cylinder bore.



EXAMPLE OF CROSS HATCH PATTERN

CYLINDER HEAD VALVE GUIDE / SEAT RECONDITION

CYLINDER HEAD RECONDITIONING NOTES

Valve Seat Inspection

Inspect valve seats in cylinder head for pitting, burnt spots, roughness, and uneven surface. If any of the above conditions exist, the valve seat must be reconditioned. *If the valve seat is cracked the cylinder head must be replaced.*

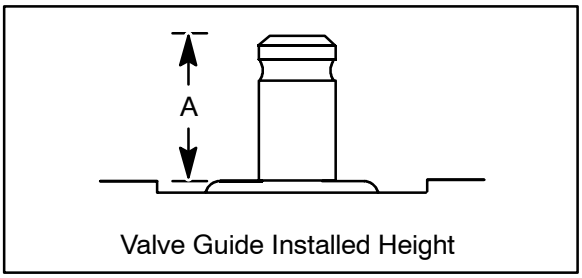
NOTE: Servicing the valve guides and valve seats requires special tools and a thorough knowledge of reconditioning techniques. Follow the instructions provided in the cylinder head service tool kit.

CAUTION: Wear the proper safety equipment when performing cylinder head service. Valve guide replacement will require heating of the cylinder head. Wear safety gloves to prevent burns.

VALVE GUIDE REMOVAL / INSTALLATION / REAM

1. Remove all carbon deposits from the combustion chamber, valve seat and valve guide area before attempting to remove valve guides. **CAUTION:** Carbon deposits are extremely abrasive and may damage the valve guide bore when guides are removed.
2. Place new valve guides in a freezer for at least 15 minutes while heating cylinder head.
3. Heat cylinder head in an oven or use a hot plate to bring cylinder head temperature to 212° F (100° C). **CAUTION:** Do not use a torch to heat cylinder head or warpage may result from uneven heating. Head temperature can be checked with a pyrometer or a welding temperature stick.
4. When thoroughly heated, place cylinder head on blocks of wood which will allow the old guides to be removed.

5. Using valve guide driver, drive guides out of the cylinder head from the combustion chamber side. Be careful not to damage guide bore or valve seat when removing guides.
6. Place cylinder head on cylinder head table. **NOTE:** Be sure cylinder head is still at 212° F (100° C) before installing new guides.
7. Place a new guide in the valve guide installation tool and press guide in to proper depth. Check height of each guide above the cylinder head (A).

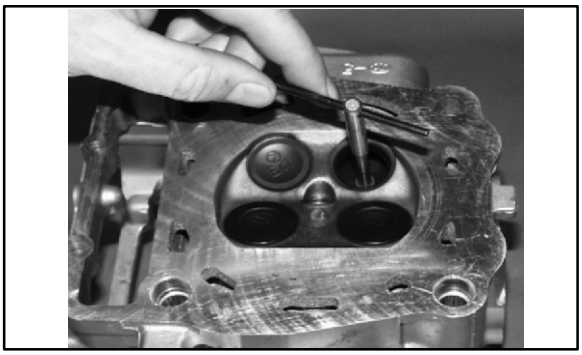


Valve Guide Installed Height

Valve Guide Height:
.689-.709″ (17.5-18.0 mm)

NOTE: The guide can also be inserted to the proper depth using a driver. Inspect the guide closely for cracks or damage if a driver is used.

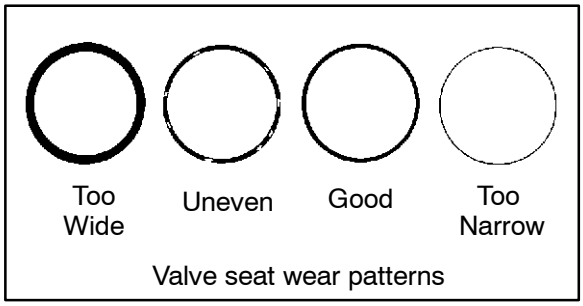
8. Allow the cylinder head to cool to room temperature. Apply cutting oil to the reamer. Guides should be reamed from the valve spring side of the cylinder head. Ream each guide to size by turning the reamer clockwise continually. Continue to rotate reamer clockwise during removal of the tool.



9. Clean guides thoroughly with hot soapy water and a nylon brush. Rinse and dry with compressed air. Apply clean engine oil to guides.

VALVE SEAT RECONDITIONING

Follow the manufacturers instructions provided with the Valve Seat Reconditioning Kit (**PN 2200634**). Abrasive stone seat reconditioning equipment can also be used. Keep all valves in order with their respective seat.

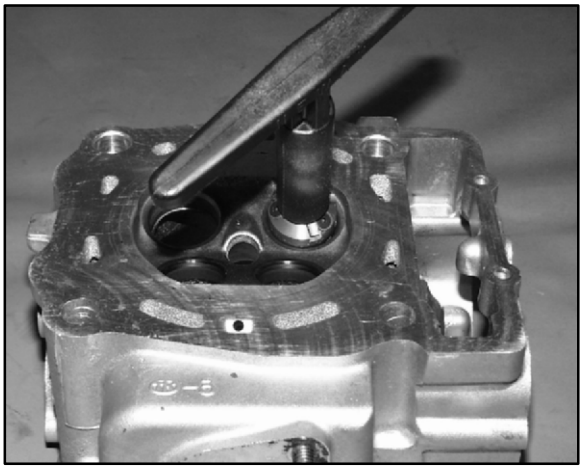


Valve seat wear patterns

NOTE: Valve seat width and point of contact on the valve face is very important for proper sealing. The valve must contact the valve seat over the entire circumference of the seat, and the seat must be the proper width all the way around. If the seat is uneven, compression leakage will result. If the seat is too wide, seat pressure is reduced, causing carbon accumulation and possible compression loss. If the seat is too narrow, heat transfer from valve to seat is reduced and the valve may overheat and warp, resulting in burnt valves.

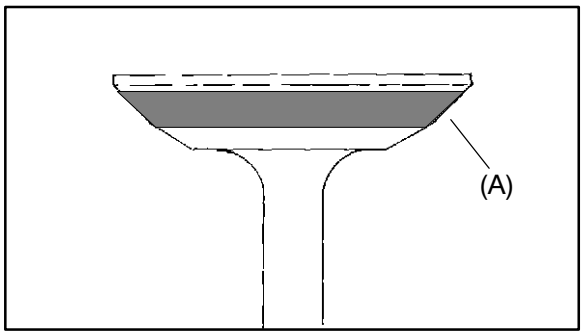
10. Install pilot into valve guide.

11. Apply cutting oil to valve seat and cutter.



12. Place 46° cutter on the pilot and make a light cut.
13. Inspect the cut area of the seat:
    - If the contact area is less than 75% of the circumference of the seat, rotate the pilot 180° and make another light cut.
    - If the cutter now contacts the uncut portion of the seat, check the pilot. Look for burrs, nicks, or runout. If the pilot is bent it must be replaced.

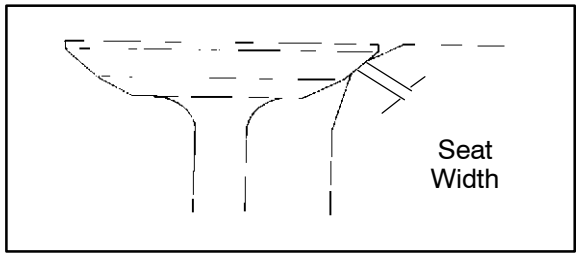
- If the contact area of the cutter is in the same place, the valve guide is distorted from improper installation and must be replaced. Be sure the cylinder head is at the proper temperature and replace the guide.
- If the contact area of the initial cut is greater than 75%, continue to cut the seat until all pits are removed and a new seat surface is evident. **NOTE:** Remove only the amount of material necessary to repair the seat surface.

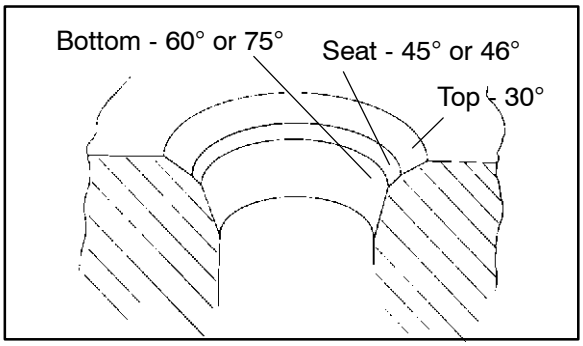


14. To check the contact area of the seat on the valve face, apply a thin coating of Prussian Blue™ paste to the valve seat. If using an interference angle (46°) apply black permanent marker to the entire valve face (A).
15. Insert valve into guide and tap valve lightly into place a few times.
16. Remove valve and check where the Prussian Blue™ indicates seat contact on the valve face. The valve seat should contact the middle of the valve face or slightly above, and must be the proper width (*Refer to the wear guide on page 3.19 for proper seat width):*
    - If the indicated seat contact is at the top edge of the valve face and contacts the margin area(B) it is too high on the valve face. Use the 30° cutter to lower the valve seat.
    - If too low use the 60° or 75° cutter to raise the seat. When contact area is centered on the valve face, measure seat width.
    - If the seat is too wide or uneven, use both top and bottom cutters to narrow the seat.
    - If the seat is too narrow, widen using the 45° cutter and re-check contact point on the valve face and seat width after each cut.

Valve Seat Width:

Intake Std: .028″ (.7 mm)
Limit: .055″ (1.4 mm)
Exhaust Std: .039″ (1.0 mm)
Limit: .071″ (1.8 mm)





NOTE: When using an interference angle, the seat contact point on the valve will be very narrow, and is a normal condition. Look for an even and continuous contact point on the black marker, all the way around the valve face.

17. Clean all filings from the area with hot soapy water, rinse, and dry with compressed air.
18. Lubricate the valve guides with clean engine oil, and apply oil or water based lapping compound to the face of the valve. NOTE: Lapping is not required with an interference angle.
19. Insert the valve into its respective guide and lap using a lapping tool or a section of fuel line connected to the valve stem.
20. Rotate the valve rapidly back and forth until the cut sounds smooth. Lift the valve slightly off of the seat, rotate 1/4 turn, and repeat the lapping process. Do this four to five times until the valve is fully seated, and repeat process for the other valve(s).
21. Clean cylinder head, valves, and camshaft oil supply passages thoroughly.
22. If an oil passage blind plug was removed, apply Crankcase Sealant (**PN 2871557**) or equivalent sealer to the threads and install, torquing to **8 ft. lbs. (11 Nm)**. **CAUTION:** Do not allow sealant to enter oil passage.
23. Spray electrical contact cleaner into oil passage and dry using compressed air.

TROUBLESHOOTING

Engine Turns Over But Fails to Start

- No fuel
- Dirt in fuel line or filter
- Fuel will not pass through fuel valve
- Fuel pump inoperative/restricted
- Tank vent plugged
- Carb starter circuit
- Engine flooded
- Low compression (high cylinder leakage)
- No spark (Spark plug fouled)

Engine Does Not Turn Over

- Dead battery
- Starter motor does not turn
- Engine seized, rusted, or mechanical failure

Engine Runs But Will Not Idle

- Restricted carburetor pilot system
- Carburetor misadjusted
- Choke not adjusted properly
- Low compression
- Crankcase breather restricted

Engine Idles But Will Not Rev Up

- Spark plug fouled/weak spark
- Broken throttle cable
- Obstruction in air intake
- Air box removed (reinstall all intake components)
- Incorrect or restricted carburetor jetting
- ETC switch limiting speed
- Reverse speed limiter limiting speed
- Carburetor vacuum slide sticking/diaphragm damaged
- Incorrect ignition timing
- Restricted exhaust system

Engine Has Low Power

- Spark plug fouled
- Cylinder, piston, ring, or valve wear or damage (check compression)
- PVT not operating properly
- Restricted exhaust muffler
- Carburetor vacuum slide sticking/diaphragm damaged
- Dirty carburetor

Piston Failure - Scoring

- Lack of lubrication
- Dirt entering engine through cracks in air filter or ducts
- Engine oil dirty or contaminated

Excessive Smoke and Carbon Buildup

- Excessive piston-to-cylinder clearance
- Wet sumping
- Worn rings, piston, or cylinder
- Worn valve guides or seals
- Restricted breather
- Air filter dirty or contaminated

Low Compression

- Decompressor stuck
- Cylinder head gasket leak
- No valve clearance or incorrectly adjusted
- Cylinder or piston worn
- Piston rings worn, leaking, broken, or sticking
- Bent valve or stuck valve
- Valve spring broken or weak
- Valve not seating properly (bent or carbon accumulated on sealing surface)
- Rocker arm sticking

Backfiring

- ETC or speed limiter system malfunction
- Fouled spark plug or incorrect plug or plug gap
- Carburetion faulty - lean condition
- Exhaust system air leaks
- Ignition system faulty:
  - Spark plug cap cracked/broken
  - Ignition coil faulty
  - Ignition or kill switch circuit faulty
  - Ignition timing incorrect
  - Sheared flywheel key
- Poor connections in ignition system
- System wiring wet
- Valve sticking
- Air leaks in intake
- Lean condition

SPARK PLUG FOULING

- Spark plug cap loose or faulty
- Choke cable adjustment or plunger/cable sticking
- Foreign material on choke plunger seat or plunger
- Incorrect spark plug heat range or gap
- Carburetor inlet needle and seat worn
- Jet needle and/or needle jet worn or improperly adjusted
- Excessive carburetor vibration (loose or missing needle jet locating pins)
- Loose jets in carburetor or calibration incorrect for altitude/temperature
- Incorrect float level setting
- PVT system calibrated incorrectly or components worn or mis-adjusted
- Fuel quality poor (old) or octane too high
- Low compression
- Restricted exhaust
- Weak ignition (loose coil ground, faulty coil, stator, or ETC switch)
- ETC switch mis-adjusted
- Restricted air filter (main or pre-cleaner) or breather system
- Improperly assembled air intake system
- Restricted engine breather system
- Oil contaminated with fuel
- Restricted oil tank vent

COOLING SYSTEM TROUBLESHOOTING

Overheating

- Low coolant level
- Air in cooling system
- Wrong type of coolant
- Faulty pressure cap or system leaks
- Restricted system (mud or debris in radiator fins or restriction to air flow, passages blocked in radiator, lines, pump, or water jacket)
- Lean mixture (restricted jets, vents, fuel pump or fuel valve)
- Fuel pump output weak
- Restricted radiator (internally or cooling fins)
- Water pump failure
- Cooling system restriction
- Cooling fan inoperative or turning too slowly (perform current draw test)
- Ignition timing misadjusted
- Low oil level
- Spark plug incorrect heat range
- Faulty hot light circuit
- Thermostat stuck closed or not opening completely

Temperature Too Low

- Thermostat stuck open

Leak at Water Pump Weep Hole

- Faulty water pump mechanical seal (coolant leak)
- Faulty pump shaft oil seal (oil leak)

NOTES

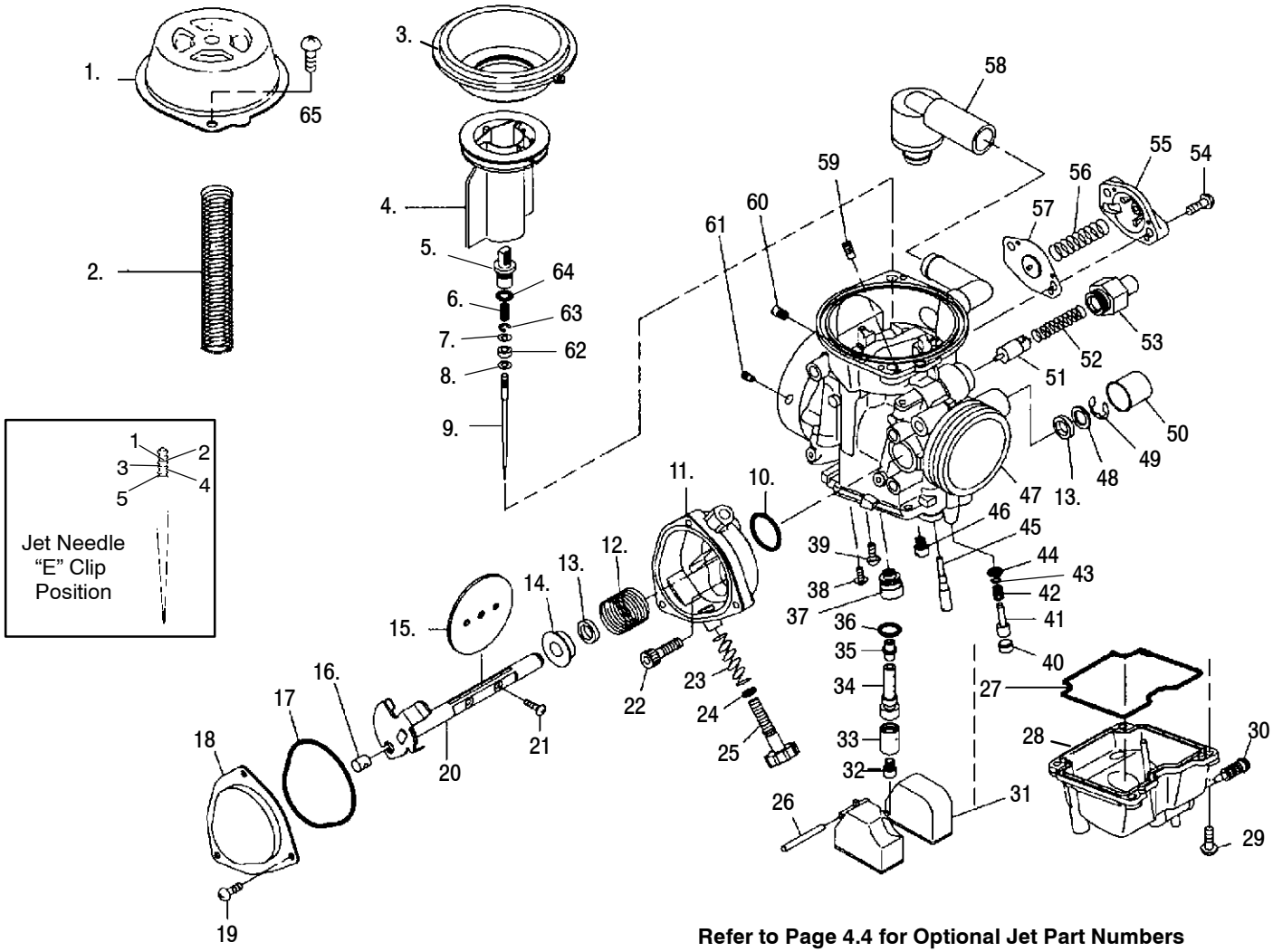
CHAPTER 4
FUEL SYSTEM/CARBURETION

4

BSR 42 CARBURETOR EXPLODED VIEW

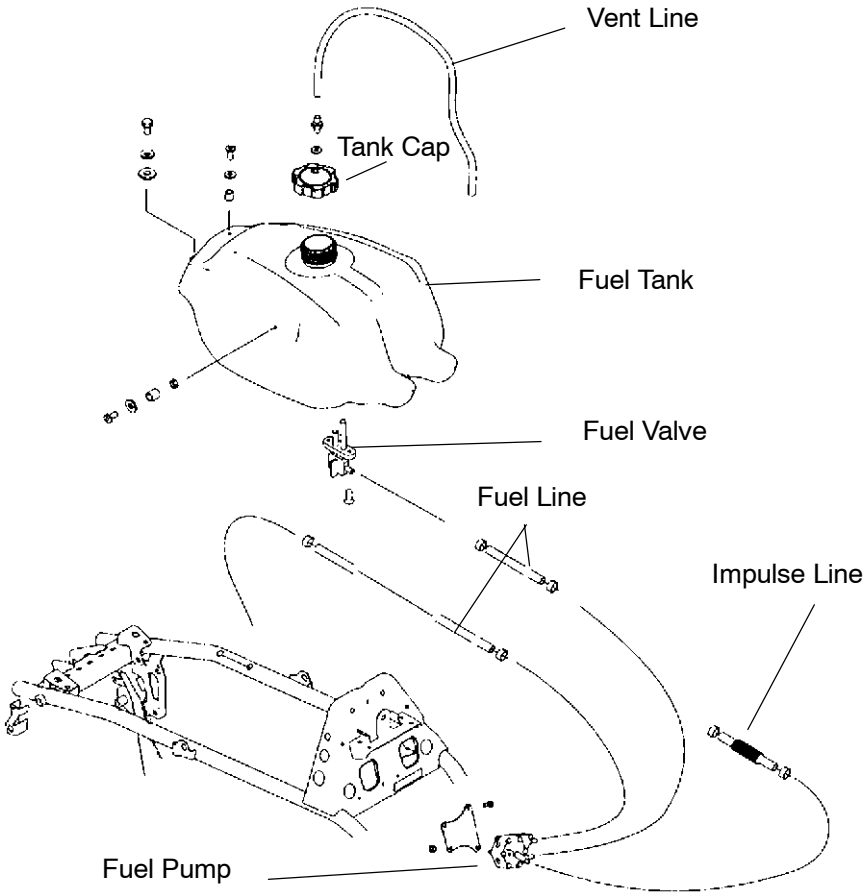
Ref.	Description	Ref.	Description
1.	Cover, Diaphragm	17.	O-Ring
2.	Spring	18.	Cover
3.	Diaphragm	19.	Screw
4.	Valve, Piston	20.	A-Shaft, Throttle
5.	Holder	21.	Screw
6.	Spring	22.	Bolt
7.	Washer	23.	Spring, Throttle Adjust
8.	Washer	24.	O-Ring
9.	Jet, Needle	25.	Screw, Adjust
10.	O-Ring	26.	Pin, Float
11.	Case	27.	O-Ring
12.	Spring	28.	Body, Float
13.	Seal	29.	Screw
14.	Ring	30.	Screw
15.	Valve, Throttle (105)	31.	A-Float
16.	Guide, Cable	32.	Jet, Main (150)

Ref.	Description	Ref.	Description
33.	Ring	49.	E-Ring
34.	Holder, Jet	50.	Cap
35.	Jet, Needle	51.	Asm., Plunger
36.	O-Ring	52.	Spring
37.	Valve, Needle	53.	Holder, Guide
38.	Screw	54.	Screw
39.	Screw	55.	Cover
40.	Plug	56.	Spring
41.	Adjuster	57.	Asm., Diaphragm
42.	Spring	58.	Filter
43.	Washer	59.	Jet, Air
44.	O-Ring	60.	Jet, Main (110)
45.	Jet, Pilot (45)	61.	Jet (120)
46.	Jet (42.5)	62.	Ring
47.	Asm., Carburetor	63.	E-Ring
48.	Packing	64.	O-Ring
		65.	Screw

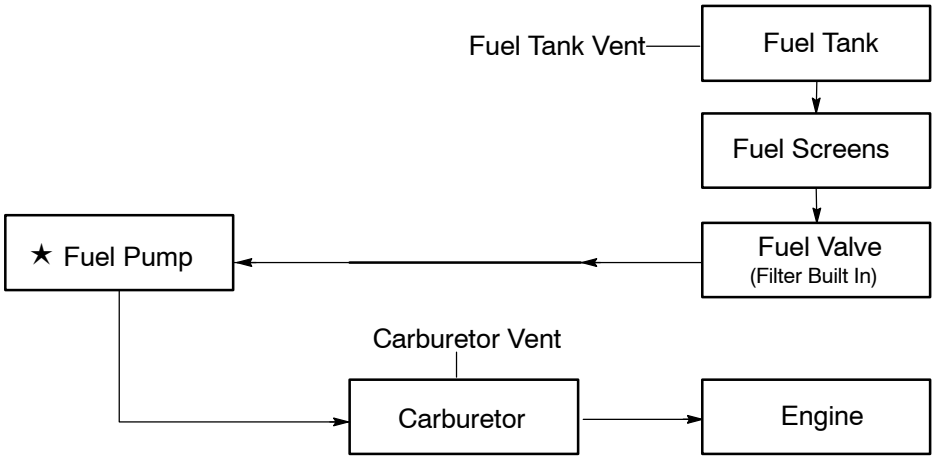


Refer to Page 4.4 for Optional Jet Part Numbers

FUEL TANK ASSEMBLY



FUEL FLOW



★ Located on upper frame

SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
2870975	Mity Vac™ Pressure Test Tool
2872314	Carburetor Float Adjustment Tool

⚠ WARNING

Gasoline is extremely flammable and explosive under certain conditions.

⚠ Always stop the engine and refuel outdoors or in a well ventilated area.

⚠ Do not overfill the tank. The tank is at full capacity when the fuel reaches the bottom of the filler neck. Leave room for expansion of fuel.

⚠ Never start the engine or let it run in an enclosed area. Gasoline powered engine exhaust fumes are poisonous and can cause loss of consciousness and death in a short time.

⚠ Never drain the float bowl when the engine is hot. Severe burns may result.

⚠ Do not smoke or allow open flames or sparks in or near the area where refueling is performed or where gasoline is stored.

⚠ If you get gasoline in your eyes or if you should swallow gasoline, seek medical attention immediately.

⚠ If you spill gasoline on your skin or clothing, immediately wash with soap and water and change clothing.

JETTING GUIDELINES

Changes in altitude and temperature affect air density, which is essentially the amount of oxygen available for combustion. In low elevations and cold temperatures, the air is more dense and has more oxygen. In higher elevations and higher temperatures, the air is less dense with reduced oxygen.

Polaris ATV Carburetors are calibrated for an altitude of 0-6000 ft. (0-1800 meters) and ambient temperatures between +40 and +80° F (+5° to +26° C). Carburetors must be re-calibrated if operated outside this temperature and/or altitude range. The jetting installed in production is not intended for all altitudes and/or temperatures. In addition, air screw / pilot screw adjustments and PVT adjustments may be required to suit operating conditions.

CARBURETOR JETTING

CAUTION:

A main jet that is too small will cause a lean operating condition resulting in serious engine damage. Select the correct main jet carefully for elevation and temperature according to the charts in the specifications section or in the Owner's Safety and Maintenance Manual for each particular model.

IMPORTANT: The following guidelines must be followed when establishing a main jet setting:

1. Select the lowest anticipated temperature at which the machine will be operated.
2. Determine the lowest approximate altitude at which the machine will be operated.
3. Select the correct main jet from the chart on Page 1.4.

MIKUNI JET PART NUMBERS

Main Jets		Pilot Jets	
Jet Number	Part Number	Jet Number	Part Number
122.5	**3140120**	40.0	**3130624**
125	**3130085**	42.5	**3130526**
130	**3140121**	45.0	**3131023**
137.5	**3130090**		
140	**3130091**		
150	**3130093**		
152.5	**3130570**		
155	**3140171**		
165	**3131143**		
170	**3130096**		
175	**3130097**		
180	**3130098**		

CV CARBURETOR SYSTEM FUNCTION

Carburetor Component Function			
System	**Main Components**	**Main Function**	**Main Affect**
Float System (Level Control)	Inlet Pipe, Needle and Seat, Float, Float Pin	Maintains specified fuel level in float chamber (carburetor float bowl)	All systems All throttle ranges
Venting	Passages in Carburetor, Vent lines to frame	Supplies atmospheric pressure to float chamber	All systems All throttle ranges
Starter (Choke/Enrichment)	Choke Lever, Cable, Plunger, Return Spring, Carb Passages (Starter Jet, Starter Bleed Pipe)	Supplies additional fuel air mixture necessary for cold starting	All throttle ranges Greatest effect at low throttle settings and idle
Pilot (Idle System)	Pilot Jet/ Passageways, Pilot-Mixture Screw with Spring Washer and Sealing O-Ring, By-pass Ports (Behind Throttle Plate), Pilot Air Jet, Pilot Outlet, Throttle Plate	Primarily supplies fuel at idle and low throttle positions	Mainly idle to 1/4 throttle Minimal effect after 1/2 throttle
Main System	Main Jet, Main Air Jet, Main Air Passage, Needle Jet, Jet Needle, Vacuum Slide, Throttle Plate	Supplies fuel at mid-range and high throttle settings.	1/4 to full throttle

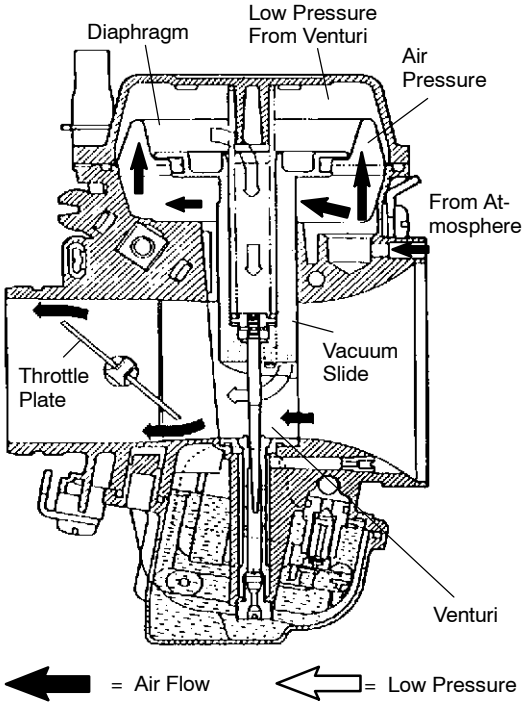
VENT SYSTEMS - CV CARBURETOR

The carburetor float bowl vent lines supply atmospheric pressure to the float bowl. The lines must be free of kinks, restrictions and be properly routed. This allows fuel to flow in the proper amount and prevents contaminants from entering the carburetor.

MIKUNI CV CARB OPERATION

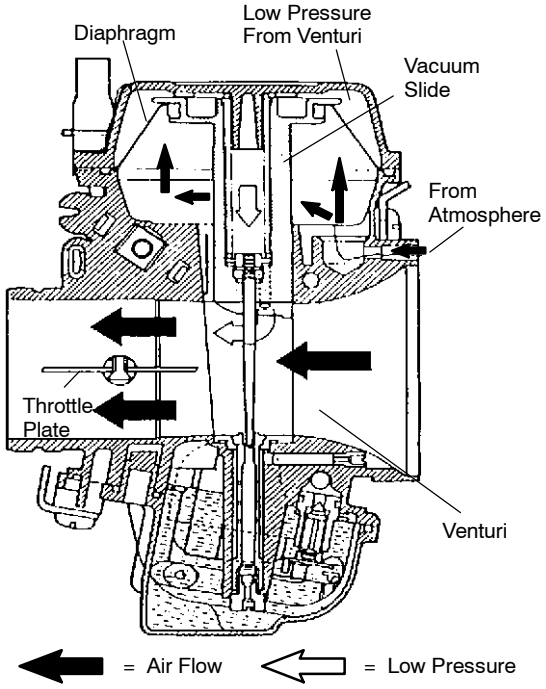
The constant velocity carburetor incorporates a mechanically operated throttle plate and a vacuum controlled slide valve (vacuum slide). The venturi cross-sectional area in the carburetor bore is increased or decreased automatically by the vacuum slide, which moves according to the amount of negative pressure (less than atmospheric) present in the venturi.

A diaphragm attached to the top of the vacuum slide is sealed to the slide and to the carburetor body forming two chambers. The chamber above the diaphragm is connected to the venturi area by a drilled orifice in the center of the vacuum slide. The chamber below the diaphragm is vented to atmospheric pressure by a passage on the air box side of the carburetor. A spring, installed in the center of the vacuum slide, dampens the slide movement and assists the return of the slide.



CARBURETOR OPERATION CONT'D

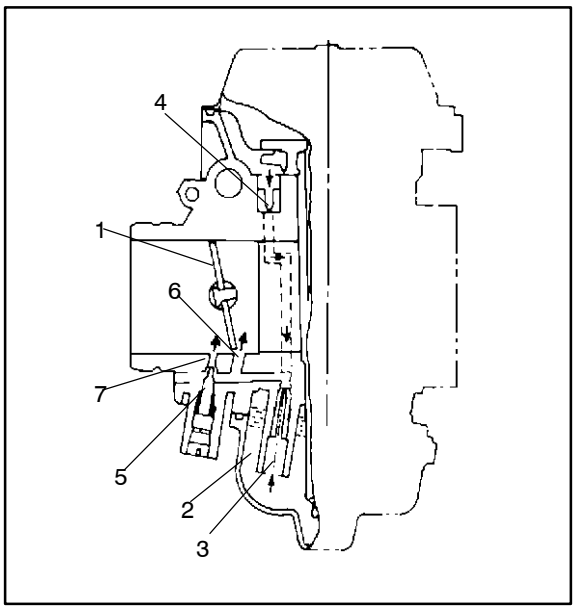
When the throttle plate is opened and engine speed begins to increase, the pressure in the venturi (and therefore in the chamber above the diaphragm) becomes significantly lower than atmospheric. Atmospheric pressure in the chamber below the diaphragm forces the diaphragm upward, raising the slide against spring pressure. When the pressure above and below the diaphragm are nearly equal, the slide moves downward under spring pressure. Raising or lowering the slide increases or decreases the cross sectional area in the venturi, and therefore the air velocity in the venturi is kept relatively constant. This provides improved fuel atomization and optimum fuel/air ratio.



Note: Diagrams are for explanation of theory only, and are not true representations of Mikuni BST carburetor.

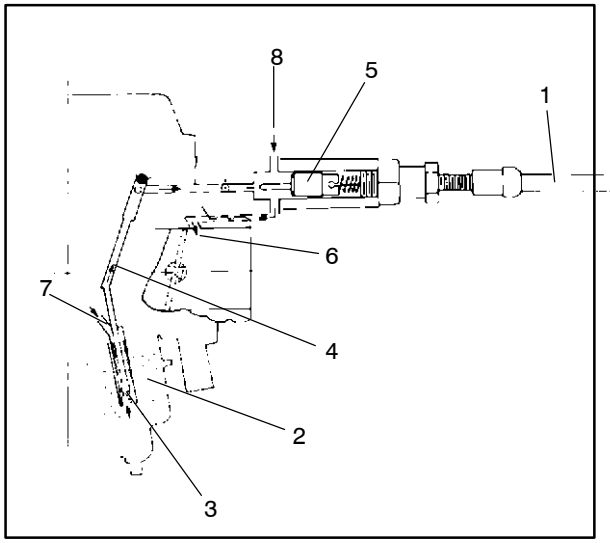
PILOT (IDLE AND SLOW) SYSTEM

This system supplies fuel during engine operation with throttle valve closed (1) or slightly opened. The fuel from float chamber (2) is metered by pilot jet (3) where it mixes with air coming in through pilot air jet (4). The mixture then goes up through pilot passage to pilot screw (5). A part of the mixture is discharged into the main bore out of bypass ports (6). The remainder is then metered by pilot screw and discharged into the main bore through pilot outlet (7).



STARTER SYSTEM (CHOKE OR ENRICHMENT)

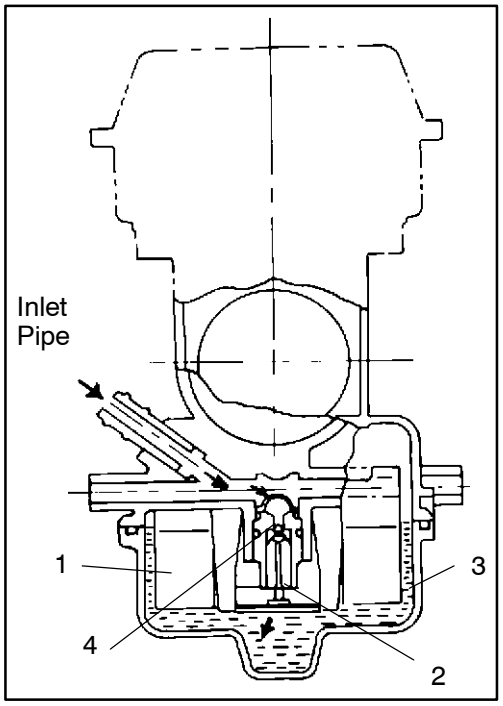
When the choke cable (1) is activated, the starter plunger (5) is lifted off the seat.



Fuel is drawn into the starter circuit from the float chamber (2) through the starter jet (3). Starter jet meters this fuel, which then flows into starter pipe (4) and mixes with the air (7) coming from the float chamber. The mixture, rich in fuel content, reaches starter plunger and mixes again with the air coming through a passage (8) extending from underneath the diaphragm. The rich fuel/air mixture for starting is discharged through starter outlet (6) in the the main bore.

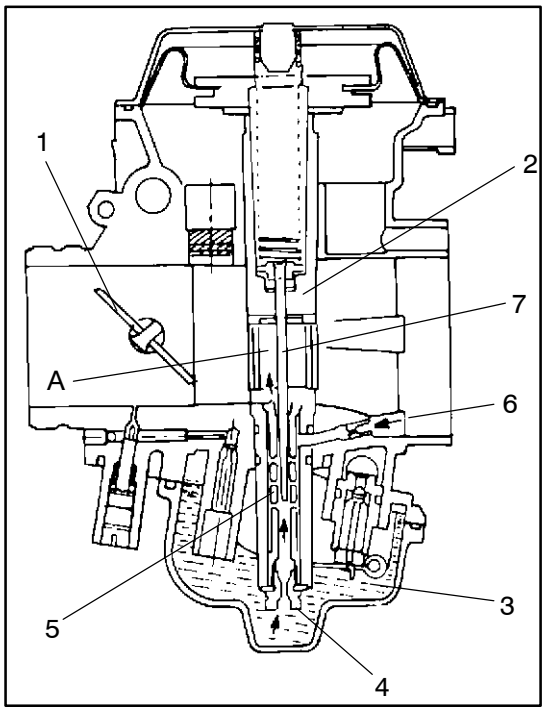
FLOAT SYSTEM

Fuel enters the float chamber (3) by means of the inlet pipe and passage, through a screen on the back of the inlet needle seat (4), and around the inlet needle (2). As the fuel fills the float chamber, the float (1) rises and forces the inlet needle against the seat, shutting off the orifice in the seat. When fuel level is up in float chamber, floats are up and needle valve remains pushed up against valve seat. Under this condition, no fuel enters the float chamber. As the fuel level falls, floats go down and needle valve unseats itself to allow fuel into the chamber. In this manner, the needle valve releases and shuts off fuel alternately to maintain a constant fuel level inside the float chamber.



MAIN SYSTEM

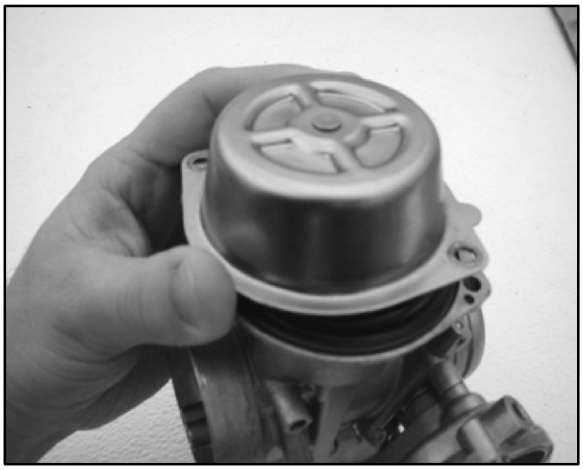
As throttle valve (1) is opened, engine speed rises, and this increases negative pressure in the venturi. Consequently the vacuum slide (2) moves upward. The fuel in float chamber (3) is metered by main jet (4), and the metered fuel enters needle jet (5), in which it mixes with the air admitted through main air jet (6) to form an emulsion. The emulsified fuel then passes through the clearance between needle jet (5) and jet needle (7), and is discharged into the venturi (A). Mixture proportioning is accomplished in needle jet (5); the clearance through which the emulsified fuel must flow is determined ultimately by throttle position and vacuum slide height.



CARBURETOR DISASSEMBLY - MIKUNI CV

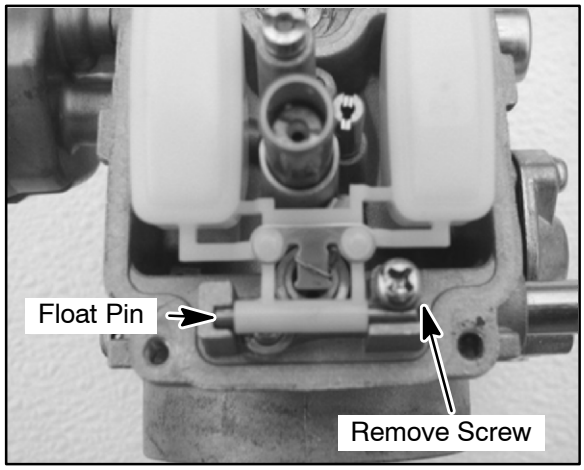
Use the following disassembly, assembly, and inspection techniques to service a CV carburetor.

1. Remove carburetor diaphragm chamber cover with a ratchet style screwdriver. DO NOT use an impact driver to remove the screws or carburetor may be permanently damaged.

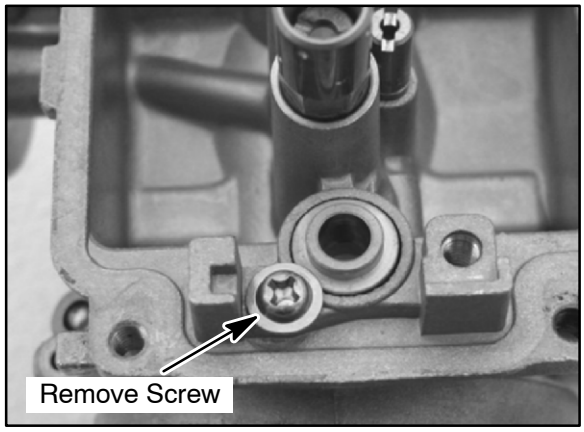


CARBURETOR DISASSEMBLY CONT'D

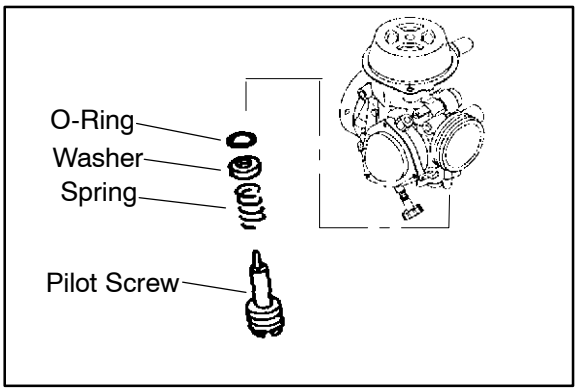
2. Remove float bowl. Remove the float pin screw. The float and float pin can be removed.



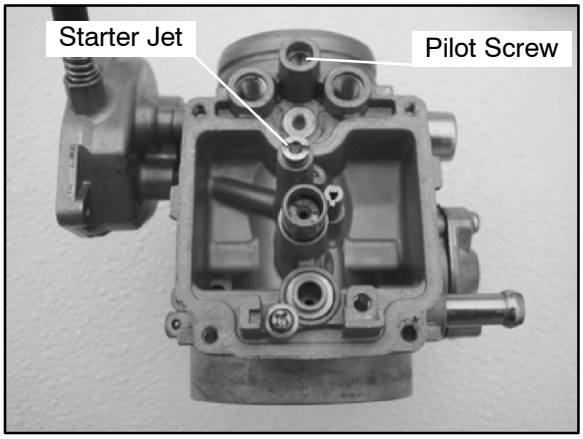
3. Remove inlet needle seat retaining screw along with plate, and carefully remove needle seat. **NOTE:** Do not use a pliers to remove the seat or permanent damage may occur.



4. Remove the pilot mixture screw, spring, flat washer, and O-Ring. If an anti-tamper plug is installed over the pilot screw cavity, it must be removed for access.



NOTE: The starter jet is removeable. Upon disassembly, place the parts in a container for safe keeping.



CARBURETOR CLEANING

⚠ WARNING

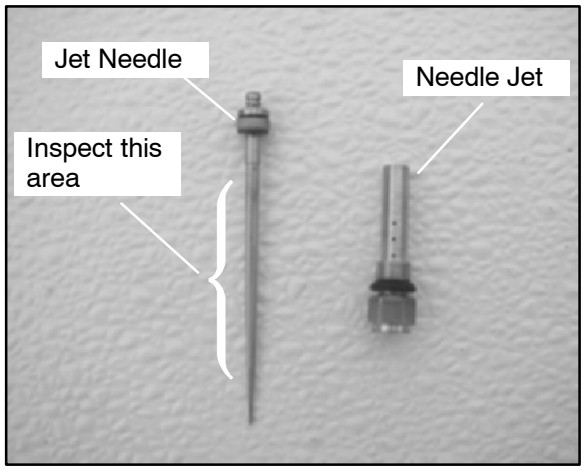
Protect eyes from contact with cleaner. Take appropriate safety measures during these procedures. Safety glasses and chemical resistant gloves are required. Should you get cleaner in your eyes or if you swallow cleaner, seek medical attention immediately.

Carburetor cleaners can be extremely caustic. Extended periods of soaking can loosen the adhesive sealer on the passage drill-way plugs. *Do not* soak rubber or plastic components (such as the vacuum slide diaphragm, needle seat screen, or O-Rings in caustic cleaning solutions. Irreparable damage may occur. Do not use agitator–type carburetor cleaning equipment. Rubber parts must be cleaned with mild detergent and hot water only.

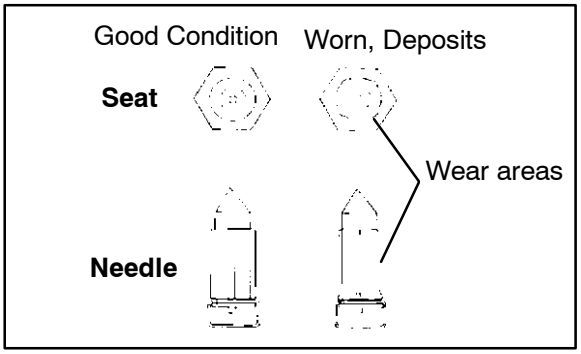
1. Thoroughly clean the carburetor body, jets, and all passages with carburetor cleaner or electrical contact cleaner.
2. If the carburetor is extremely dirty or contaminated with fuel residue and varnish, soak for short periods only in carburetor cleaner, and rinse in hot water.
3. Replace the jets if they have a buildup of fuel residue or bacterial growth that cannot be removed. Even a small amount of residue will reduce the flow characteristics of the jet.
4. Verify all passages and jets are unobstructed by spraying electrical contact cleaner through the passages. **CAUTION:** Do not use wire or welding tip cleaners as the orifice size may be altered.
5. Use low pressure air to dry carburetor body and all components.

CARBURETOR INSPECTION

1. Inspect jet needle and needle jet for wear. Look for discoloration, shiny spots, or an area that looks different than the rest of the needle. The middle to upper portion of the needle contacts the needle jet and is the most likely wear point. If jet needle shows signs of wear replace *both the needle and needle jet* to prevent a rich condition. TIP: A worn *needle jet* is difficult to spot. To check, slide a slightly larger *new jet needle* into the needle jet and hold it to a light source. Light will be visible between the needle and needle jet if it is worn.

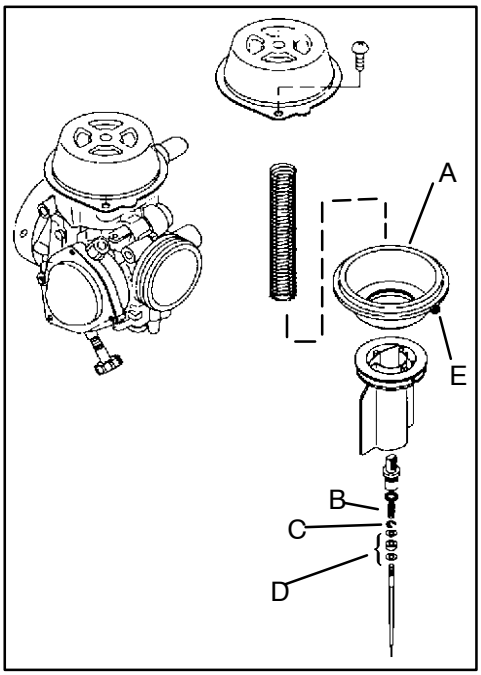


2. Inspect the inlet needle tapered surface for any sign of wear or damage. Be sure the spring loaded pin is free moving and returns freely when pushed. The inlet needle and seat should be pressure tested after assembly.

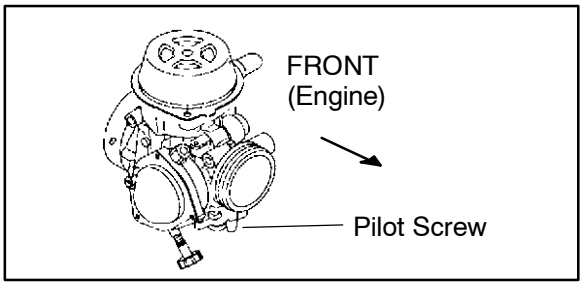


CARBURETOR ASSEMBLY

Inspect the diaphragm (A) for holes, deterioration, or damage. Make sure the diaphragm is pliable but not swollen. The diaphragm should fit properly in the carburetor body. Replace diaphragm assembly if diaphragm is damaged.



3. Replace parts in proper order. The spring seat (B) is stepped and must be placed on TOP of “E” Clip (C). Spacer washer (D) must be installed below the E-Clip. Refer to parts manual for more information.
4. Be sure the tab (E) on outer edge of diaphragm is positioned properly in the carburetor body.



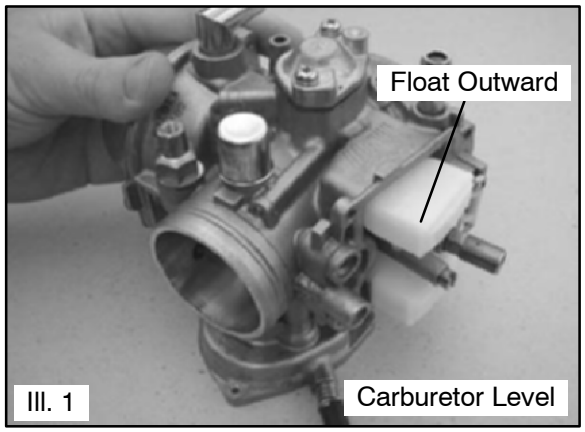
5. Install the pilot mixture screw, spring, washer, and O-ring as an assembly. Lubricate the O-Ring with oil or light grease before installation. **CAUTION:** Do not damage the O-ring during installation. Turn the screw in until it *lightly* contacts the seat. Back out the specified number of turns. NOTE: The final pilot (idle) mixture must be adjusted with the engine running. Refer to Page 2.13.

Pilot Mixture Screw Base Setting (Set at Factory)

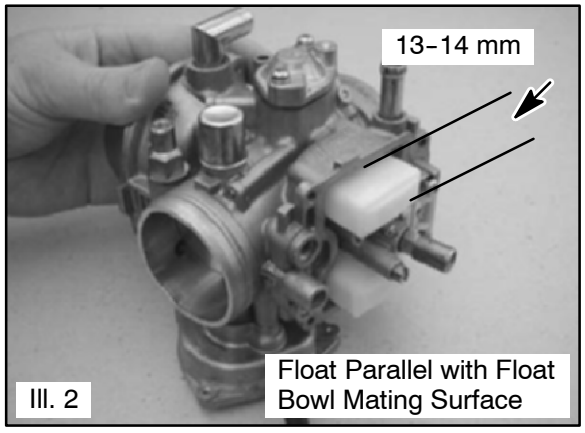
Factory Specification: 2.5 Turns Out

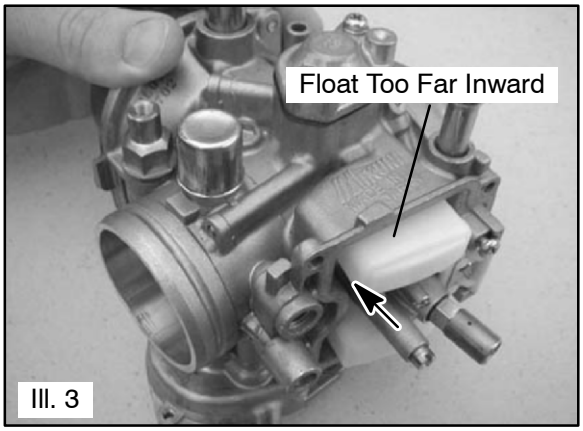
FLOAT HEIGHT ADJUSTMENT

1. **Ilustration 1**: Place the the throttle side of the carburetor on a level surface to remove weight from float arm. In this position, the float tongue will rest slightly outward.



2. **Illustration 2**: With the carburetor still resting on the level surface, use one hand to slightly tilt the carburetor back. The float will then fall into the correct position, with the float tongue resting lightly on the inlet needle valve pin without compressing the spring. The bottom of the float should be parallel with the float bowl mating surface. **Illustation 3**: **NOTE:** If the float is past parallel with the mating surface, the carburetor has been tilted back too far and the float tongue is likely compressing the needle valve pin.

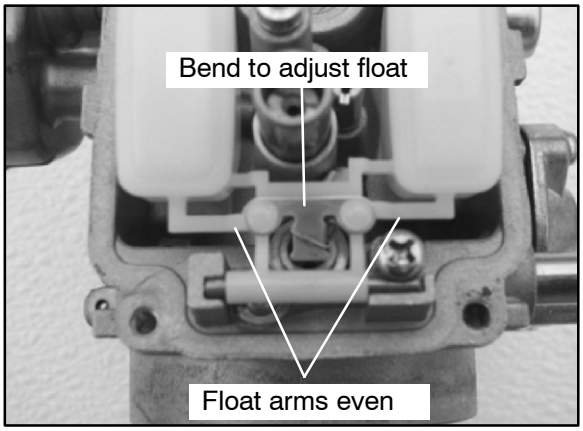




3. Measure the height from the float bowl mating surface to the top of step of the float as shown in Illustration 2. Both sides of float should be parallel to each other. The measurement should be made at the mid-point on top of the float using Float Adjustment Tool (**PN 2872314**) or a vernier caliper. When measuring the height, be sure the inlet needle valve spring is not compressed.

Float Bowl Height: 13–14 mm

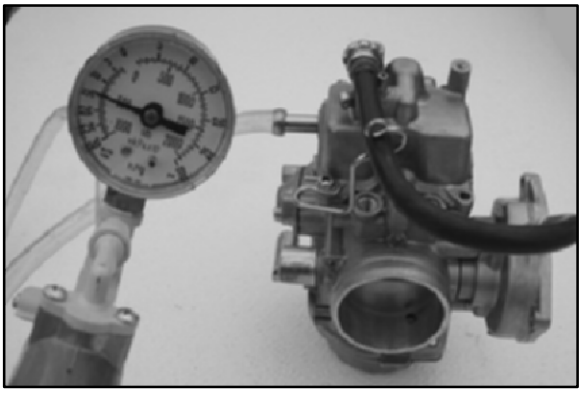
4. If adjustment is necessary, bend the tongue slightly. Be sure float measurement is even on left and right side.



NEEDLE AND SEAT LEAKAGE TEST

1. Install the float bowl. Invert the carburetor and install a Mity-Vac™ (**PN 2870975**) to the fuel inlet

fitting. Apply 5 PSI pressure to inlet fitting. The needle and seat should hold pressure indefinitely. If not, inspect needle and seat and seat O-ring.

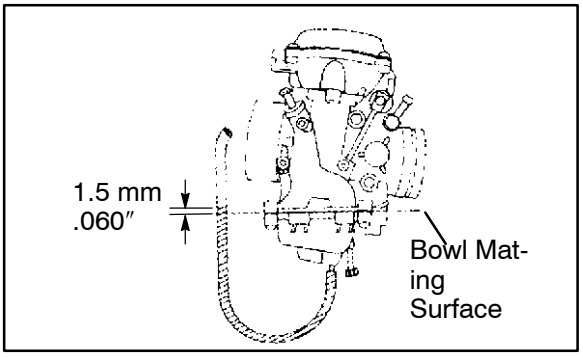


Mity Vac™ (PN 2870975)

FUEL LEVEL

A fuel level test can be performed on some models if the drain hose fitting is accessible. Be sure to re-attach the bowl drain hose after performing the test. A fuel level test allows you to observe the height of the fuel in the float bowl without removing the carburetor. The fuel level can be observed with the engine either running or shut off, however, engine must run briefly to allow fuel level to stabilize..

1. Attach a clear line to drain fitting. Be sure line fits tightly on fitting. Position hose along side of carburetor as shown.



2. Open bowl drain screw by turning counterclockwise approximately two turns. Start and run engine for 3 to 5 seconds to allow fuel level to stabilize in the line. If level is out of specification, remove carburetor and inspect inlet needle and seat, float height, passages, etc.

NOTE: If a line was removed to perform this procedure, it must be replaced.

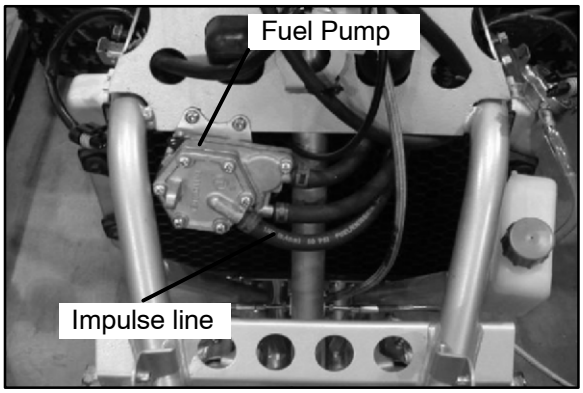
FUEL PUMP

The Predator 500 is equipped with a pressure regulated fuel pump (1-3 PSI). The pump is located in the front fender cavity of the machine.

To test the fuel pump:

1. Turn fuel off.
2. Disconnect impulse line from pump.
3. Connect Mity-Vac™ (**PN 2870975**) to the impulse line fitting on the pump.
4. Apply 5 inches (Hg) vacuum to the pump fitting. The diaphragm should hold vacuum indefinitely.

If fuel is present in the impulse line or vacuum chamber of the pump, the diaphragm is ruptured. The pump diaphragms must be replaced.



FUEL PUMP DISASSEMBLY

1. Remove the screws from the pump diaphragm cover. Note the location of the two longer screws.
2. Remove the diaphragm cover gasket, diaphragm, and valve body gasket.
3. Remove the outlet check valve cover, diaphragm, and gasket.

FUEL PUMP INSPECTION/ASSEMBLY

1. Inspect inlet and outlet check valves for cracks, warpage or damage. Inspect the diaphragms for cracks, holes or swelling.
2. To clean the valves or pump body, remove the set screw and washer. Remove the valve and wash with soap and water. Carburetor cleaner may be used to clean the pump body when the check valves are removed. **CAUTION:** Some carburetor cleaners are very caustic and should not be used to clean the non-metal parts of the fuel pump.
3. Check the sealing surfaces of the pump body and covers. Carefully remove all traces of old gasket

and check the surfaces for damage. Replace diaphragms and gaskets as a set.

4. Reassemble the pump in the reverse order of disassembly. Tighten all screws evenly.

TROUBLESHOOTING

FUEL STARVATION/LEAN MIXTURE

Symptoms: Hard start or no start, bog, backfire, popping through intake / exhaust, hesitation, detonation, low power, spark plug erosion, engine runs hot, surging, high idle, idle speed erratic.

- No fuel in tank
- Restricted tank vent, or routed improperly
- Fuel lines or fuel valve restricted
- Fuel filter plugged
- Carburetor vent line(s) restricted
- Plugged or restricted inlet needle and seat screen or inlet passage
- Clogged jets or passages
- Float stuck, holding inlet needle closed or inlet needle stuck
- Float level too low
- Fuel pump inoperative
- Air leak at impulse line
- Restricted impulse line (kinked, pinched)
- Intake air leak (throttle shaft, intake ducts, airbox or air cleaner cover)
- Ruptured vacuum slide diaphragm, Vacuum slide stuck closed or sticky
- Improper spring
- Jet needle position incorrect
- Incorrect pilot screw adjustment

RICH MIXTURE

Symptoms: Fouls spark plugs, black, sooty exhaust smoke, rough idle, poor fuel economy, engine runs rough/ misses, poor performance, bog, engine loads up, backfire.

- Air intake restricted (inspect intake duct)
- Air filter dirty/plugged
- Choke plunger sticking, incorrectly adjusted choke
- Choke cable binding or improperly routed
- Incorrect pilot air/fuel screw adjustment
- Faulty inlet needle and seat
- Faulty inlet needle seat O-Ring
- Float level too high
- Poor fuel quality (old fuel)
- Loose jets
- Worn jet needle/needle jet or other carburetor parts
- Dirty carburetor (air bleed passages or jets)
- Weak or damaged vacuum piston return spring
- Fouled spark plug

POOR IDLE

Idle Too High

- Idle adjusted improperly/idle mixture screw damaged
- Sticky vacuum slide
- Throttle cable sticking, improperly adjusted, routed incorrectly
- Choke cable sticking, improperly adjusted, routed incorrectly
- Plugged or restricted idle jet

Idle Too Low

- Choke cable bending or incorrectly adjusted
- Idle speed set incorrectly
- Idle mixture screw misadjusted or damaged
- Belt dragging
- Ignition timing incorrect
- Worn jet needle/needle jet
- Plugged or restricted idle jet

Erratic Idle

- Choke cable bending or incorrectly adjusted
- Throttle cable incorrectly adjusted
- Air leaks, dirty carburetor passages (pilot circuit)
- Pilot mixture screw damaged or adjusted incorrectly
- Tight valves
- Ignition timing incorrect
- Belt dragging
- Dirty air cleaner
- Engine worn
- Spark plug fouled
- Idle speed set incorrectly (speed limiter)
- Worn jet needle/needle jet
- Plugged or restricted idle jet

CHAPTER 5
BODY AND STEERING

TORQUE SPECIFICATIONS

PART NUMBER	TOOL DESCRIPTION
Front A-Arm Attaching Bolts	30 ft. lbs. (41 Nm)
Front A-Arm Ball Joint Stud Nut	35 ft. lbs. (47 Nm)
Handlebar Adjuster Block	10-12 ft. lbs. (14-17 Nm)
Master Cylinder Mount Bolts	45-55 in. lbs. (5.2-6.3 Nm)
Rear Axle Nut	8–10 ft. lbs (11–14 Nm)
Rear Axle Nut Pinch Bolt	50 in. lbs (6 Nm)
Rear Shock Bolt (top & bottom)	55 ft. lbs. (75 Nm)
Front Spindle Nut	40 ft. lbs. (54 Nm)
Front Wheel Nut	20 ft. lbs. (27 Nm)
Rear Hub Nut	80 ft. lbs. (110 Nm)
Rear Wheel Nut	20 ft. lbs. (27 Nm)
Swing Arm Pivot Bolt / Rear Engine Mount Bolt	95 ft. lbs (129 Nm)
Tie Rod End Jam Nut	14 ft. lbs. (19 Nm)
Tie Rod End Attaching Nut	30 ft. lbs. (35-41 Nm)

SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
2870871	Ball Joint Replacement Tool
2870872	Shock Spanner Wrench
2870623	Shock Absorber Spring Compression Tool
2871572	Strut Rod Wrench
2871573	LH Strut Spring Compressor
2871574	RH Strut Spring Compressor
7052069	Charging Needle
2200421	Gas Shock Recharging Kit
2871352	Shock Rod Holding Tool
2871199	Seal Sleeve Installation Tool Kit
2870872	Shock Spanner Wrench
2871351	Fox™ Shock IFP Depth Tool

COVER/PANEL REMOVAL

Refer to the exploded view on Page 5.3

To Remove: — **Perform These Steps:**

Seat . . . . . Pull release lever at right rear of seat. Lift and pull seat rearward, disengaging seat from the front cab

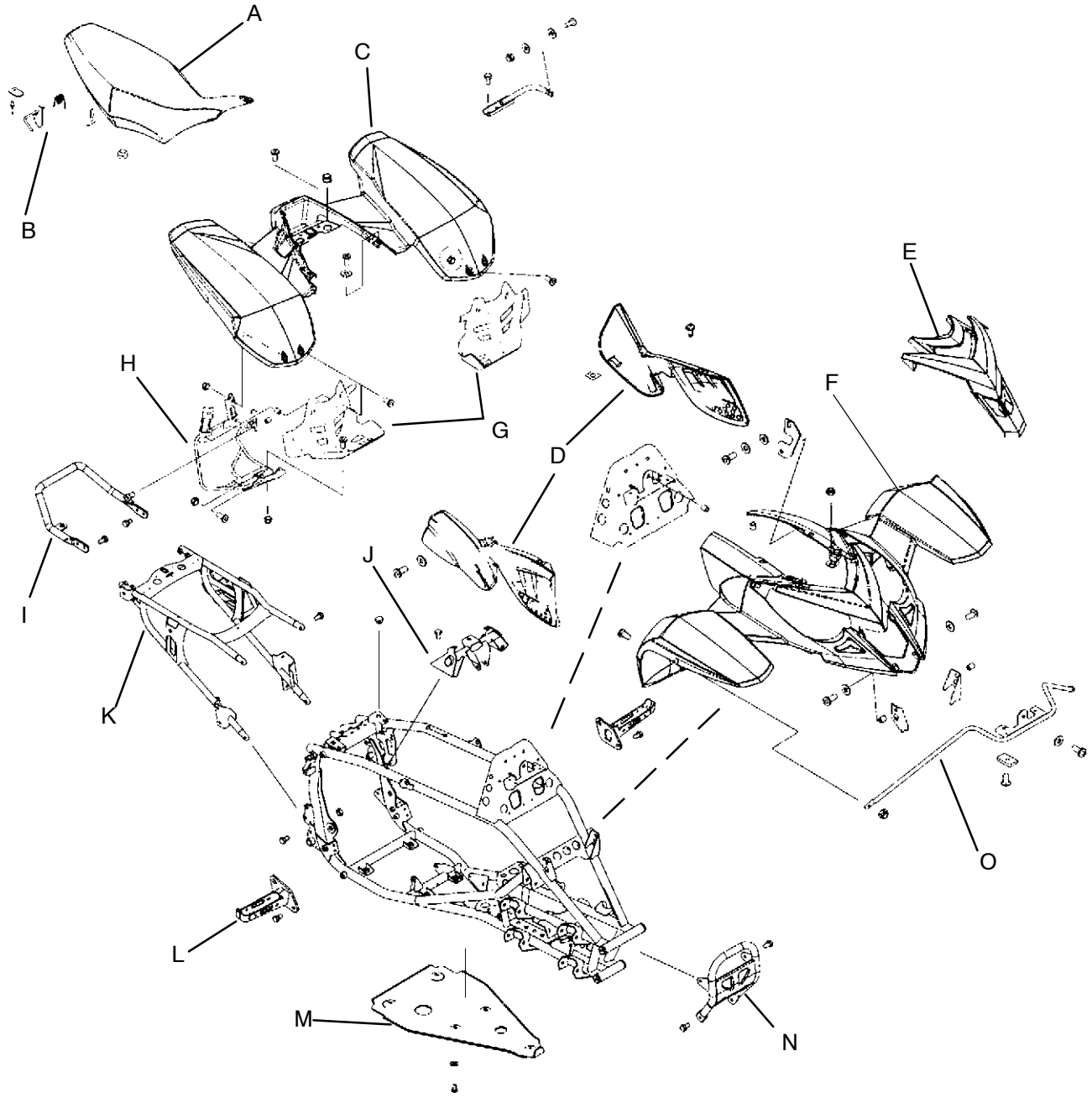
Front Cab / Headlight Cover . . . . . **Remove:** (3 – T25 Torx™ bolts) 2 screws on front cab section of frame upport (left & right sides). 1 screw in center of cab to frame.

Heel Pockets / Side Covers . . . . . **Remove:** Seat
Heel Pocket (G) – 4 screws attach Heel Pocket (G) to Support (H) (Both Sides)
Side Covers (D) – Remove 3 screws that secure to the frame (Both Sides)

Rear Cab . . . . . **Remove:** 4 screws under back of seat area. 2 screws that attach fender to Heel Support (H) (Both Sides)

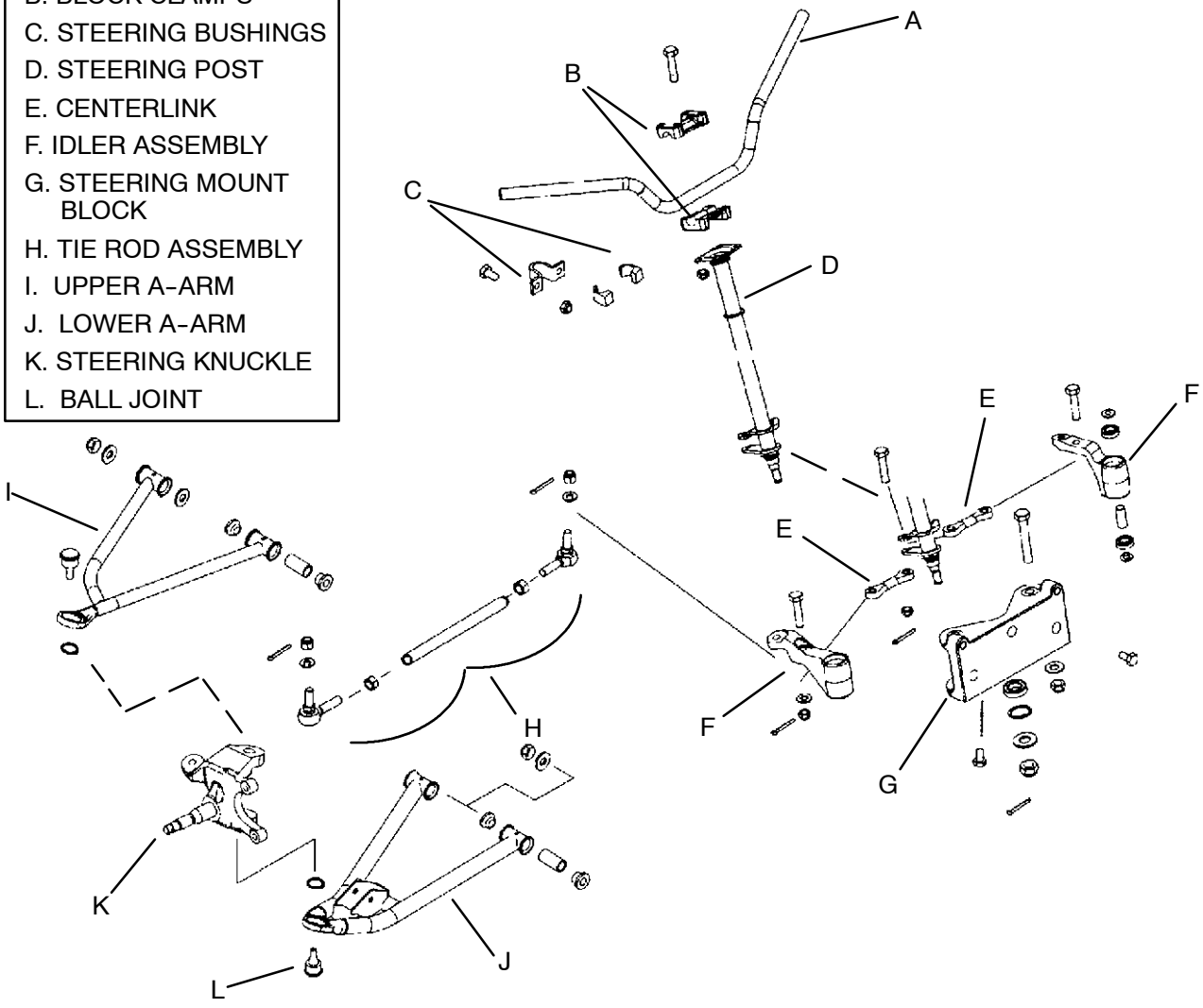
BODY ASSEMBLY EXPLODED VIEW

A. Seat
B. Seat Release Latch
C. Rear Cab
D. Side Panel
E. Front Cover
F. Front Cab
G. Heel Pocket
H. Heel Support
I. Grab Bar
J. Fuel Tank Support
K. Rear Frame
L. Foot Peg
M. Rock Guard
N. Front Bumper
O. Front Cab Support

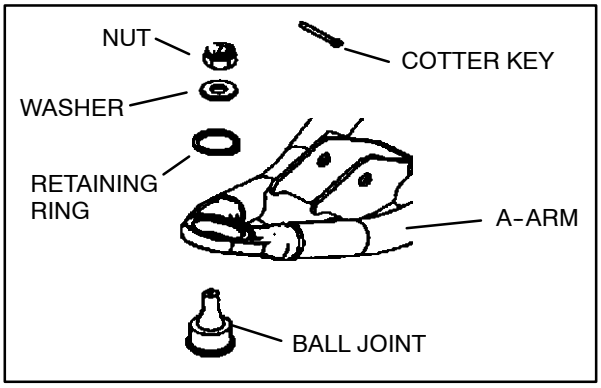


STEERING ASSEMBLY, EXPLODED VIEW

A. HANDLEBAR
B. BLOCK CLAMPS
C. STEERING BUSHINGS
D. STEERING POST
E. CENTERLINK
F. IDLER ASSEMBLY
G. STEERING MOUNT BLOCK
H. TIE ROD ASSEMBLY
I. UPPER A-ARM
J. LOWER A-ARM
K. STEERING KNUCKLE
L. BALL JOINT



BALL JOINT CONFIGURATION

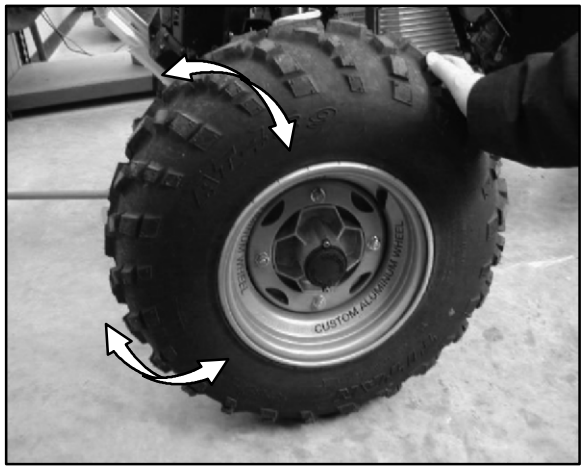


FRONT HUB REMOVAL / DISASSEMBLY

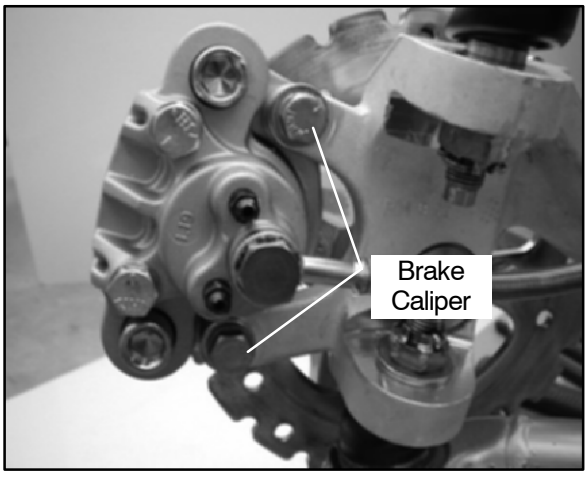
1. Elevate front end and safely support machine under footrest / frame area.

Serious injury may result if machine tips or falls. Be sure machine is secure before beginning this service procedure. Wear eye protection when removing bearings and seals.

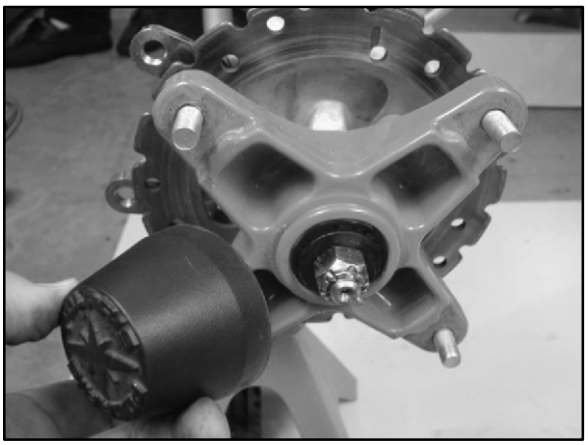
2. Check bearings for side play by grasping tire / wheel firmly (top and bottom) and checking for movement. It should rotate smoothly without binding or rough spots.



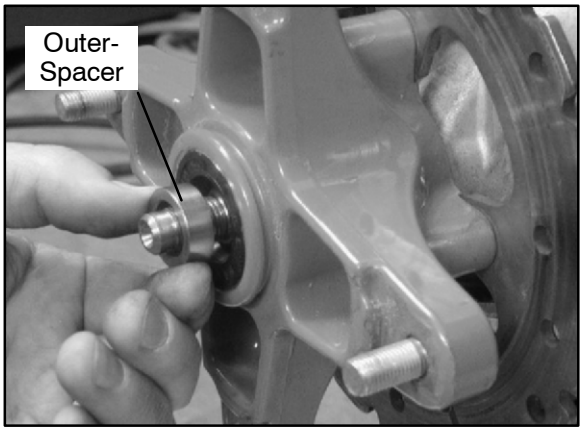
3. Remove wheel nuts and wheel.
4. Remove the two brake caliper bolts and the brake caliper. Use mechanic's wire or other suitable material to support the caliper assembly. Do not allow caliper assembly to hang by the brake line!



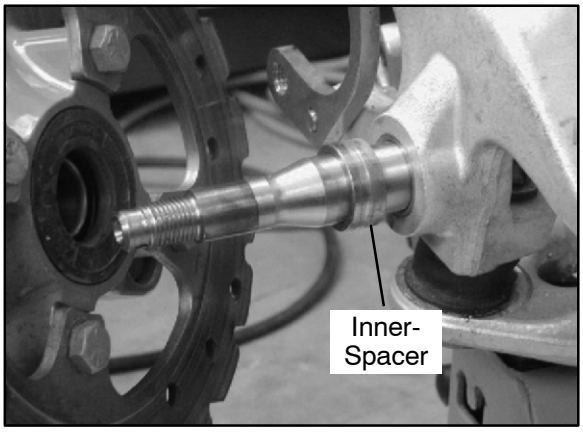
5. Remove hub cap, cotter pin, front spindle nut, and washer.



6. Remove the outer spacer from the spindle. Inspect outer spacer for wear, replace if needed.

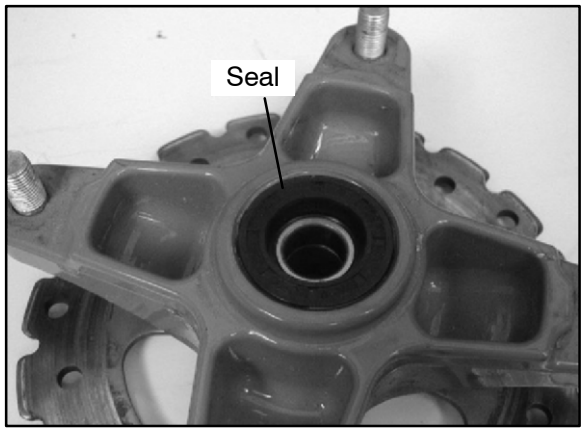


7. Remove the the hub from the spindle. Remove the inner spacer from the spindle. Inspect the inner spacer for wear, replace if needed.

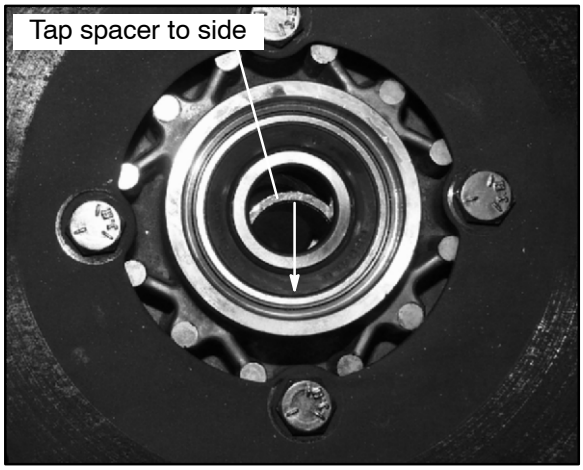


8. Rotate each bearing inside the hub by hand and check for smooth rotation. Visually inspect bearing for moisture, dirt, or corrosion. Replace bearing if moisture, dirt, corrosion, or roughness is evident.

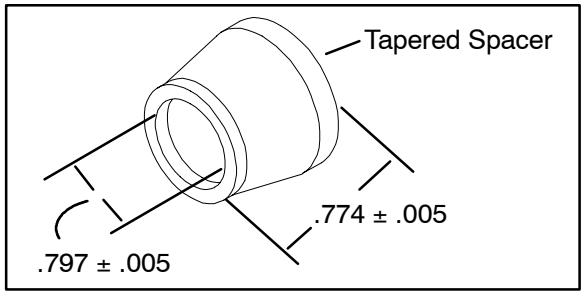
9. Place a shop towel on hub to protect surface. Carefully pry seal out of hub.



10. Using a brass drift, tap bearing spacer to one side to expose inner bearing race. Drive bearing out using a drift through opposite side of hub and discard.

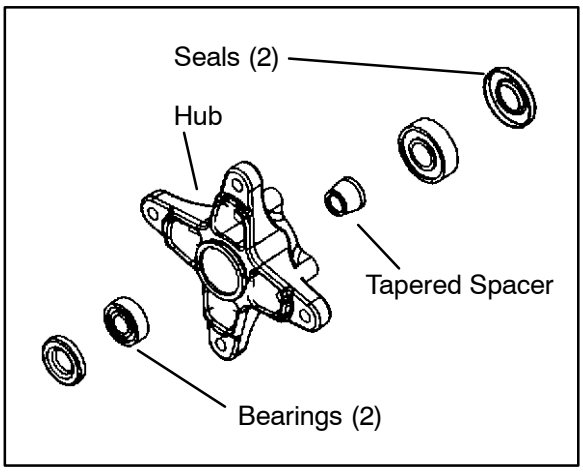


11. Remove spacer. Drive other bearing out and discard.
12. Clean hub and spacer thoroughly.
13. Inspect spacer for wear or damage. Measure the tapered spacer for wear, replace as needed.



FRONT HUB ASSEMBLY

1. Drive or press one new bearing into hub using a bearing driver.

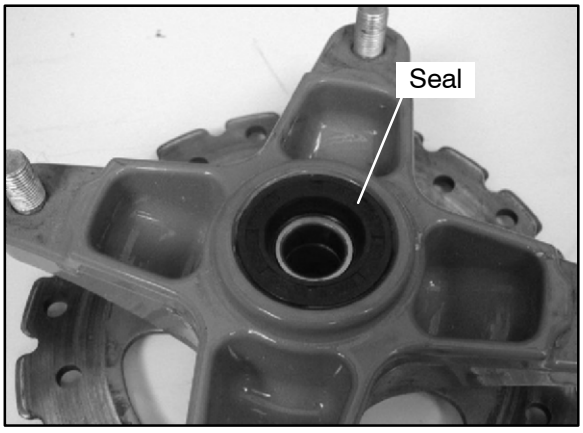


CAUTION: *Do not* drive on the inner race of the bearing.

Premium All-Season Grease	
(PN 2871322)	(3 oz. Tube)
(PN 2871423)	(14 oz. Tube)

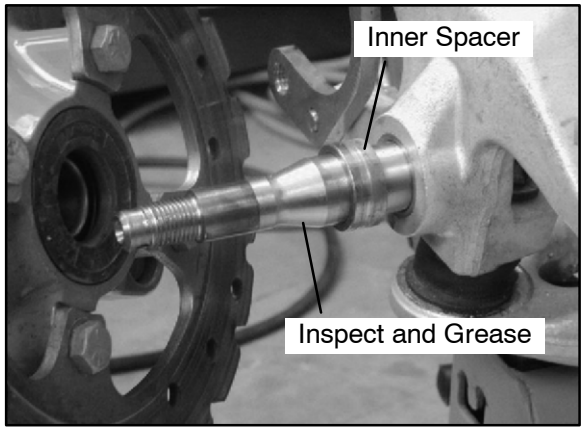
2. Coat bearing spacer with grease and install into hub. Drive or press the other bearing into hub until seated against spacer.

3. Install seal into hub (with numbers facing out) until flush with end of seal bore.

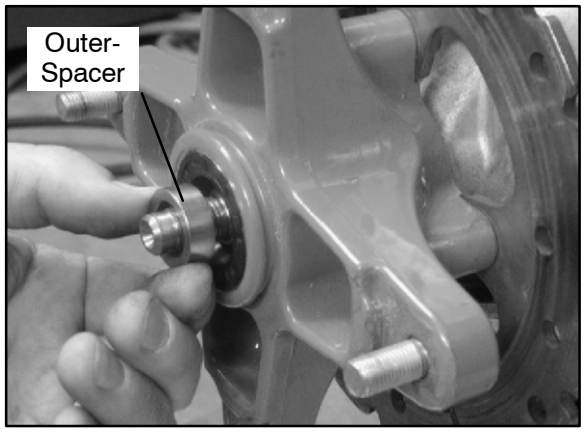


FRONT HUB INSTALLATION

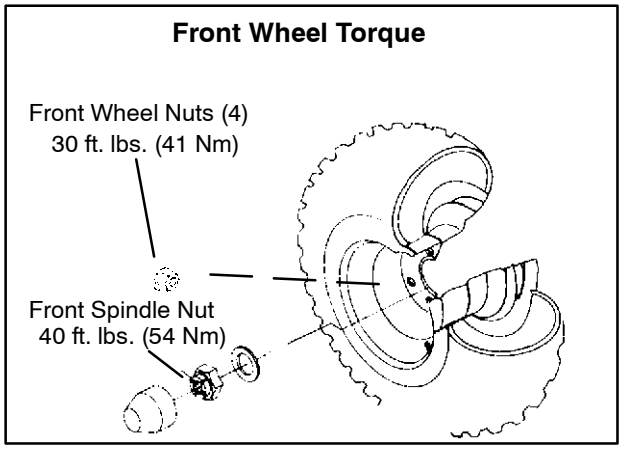
1. Apply grease to spindle.
2. Inspect spindle and bearing surface for wear or damage. Install the inner spacer.



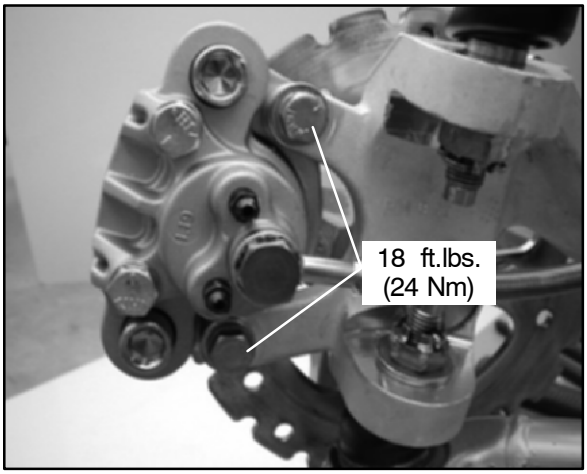
3. Install hub on spindle. Install the outer spacer.



4. Install the washer and spindle nut. Torque the spindle nut to 40 ft. lbs. (54 (Nm)



5. Install a new cotter pin. Tighten nut slightly if necessary to align cotter pin holes.
6. Rotate wheel and check for smooth operation. Bend both ends of cotter pin around end of spindle in different directions.
7. Install hub cap.
8. Rotate hub. It should rotate smoothly without binding or rough spots or side play.
9. Install brake caliper. Tighten bolts to **18 ft.lbs (24 Nm)**.

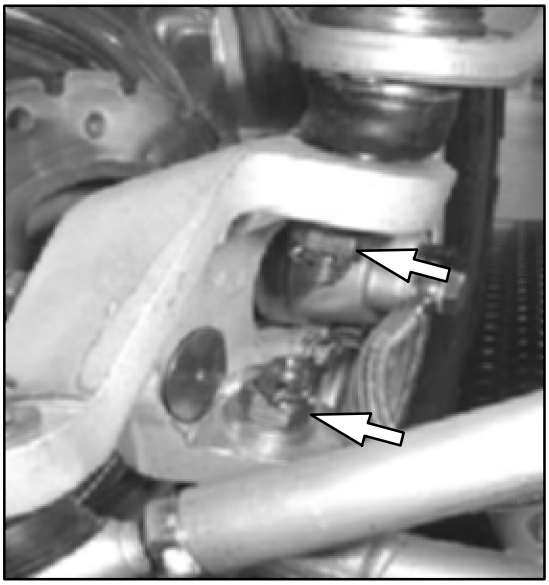


10. Install the wheel and four wheel nuts finger tight. Lower the ATV and torque the wheel nuts to **30 ft.lbs. (41 Nm).**

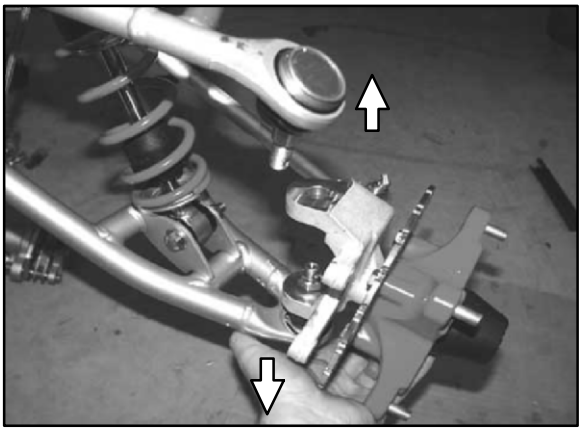
STEERING KNUCKLE REMOVAL / INSTALLATION

Removal

1. Follow the steps in the “Front Hub Removal” section to remove the hub, if needed.
2. Remove the upper and lower ball joint cotter keys and castle nuts.



3. Lift up on the upper A-arm and pull the top ball joint from the steering knuckle. Push down on the lower A-arm to move the lower ball joint from the steering knuckle



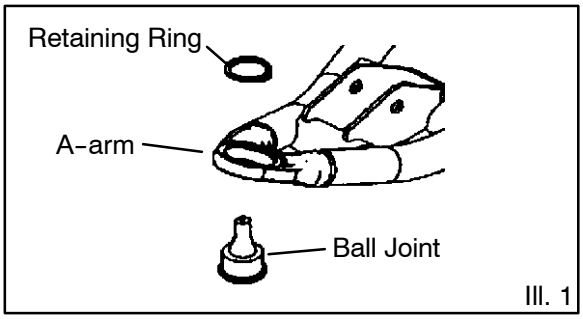
Installation

4. Before installation check the condition of the ball joints.
5. Place the upper and lower A-arms into the steering knuckle.
6. Install the castle nuts onto the upper and lower A-arms. Torque the nuts to 25 ft.lbs. (35 Nm).
7. Install new cotter pins into the castle nuts and ball joints.

BALL JOINT REMOVAL / INSTALLATION

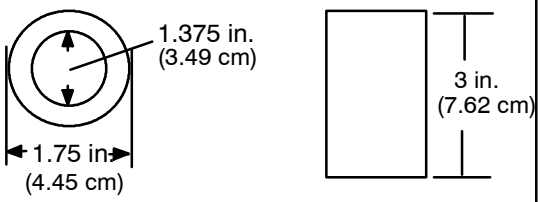
Ball Joint Removal

1. The A-arm must be removed to perform this procedure, Refer to “A-arm Replacement” on Page 10.
2. Be sure to remove the retaining ring from the top of the ball joint (See Ill. 1).



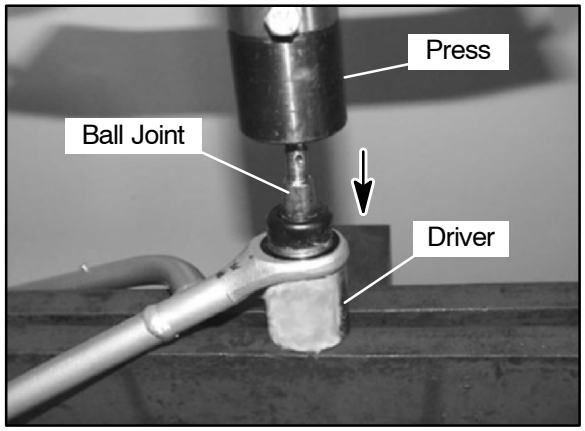
Ill. 1

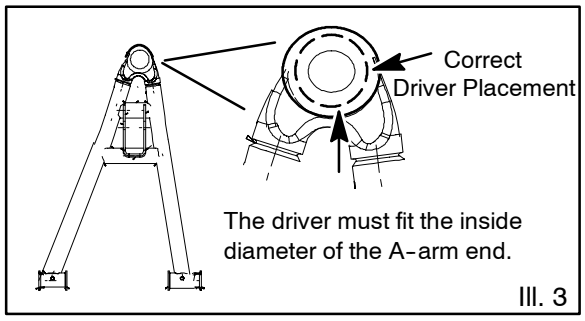
Driver Dimensions



*Outside diameter of driver cannot be any larger than 1.75 in. Inside diameter cannot be any smaller than 1.375 in.. Driver must be 3 in. or taller.

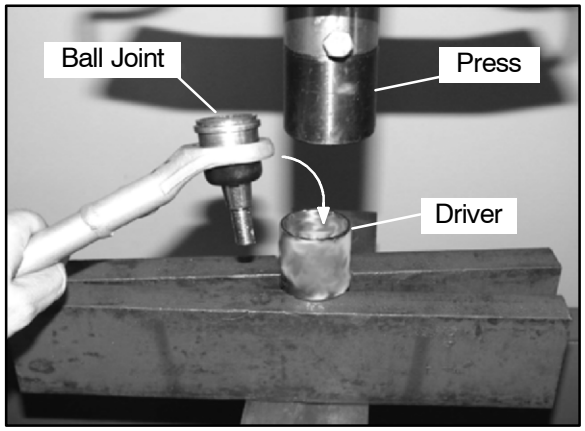
3. A driver must be used for the removal of the ball joints. Use the dimensions above to fabricate or locate the correct size driver to use in the following process.
4. Use a press and correct size driver to remove the ball joint from the A-arm. **NOTE:** The driver must fit the inside diameter of the A-arm (See Ill. 3 below). This will allow the ball joint to be properly pressed out of the A-arm without damaging the A-arm.

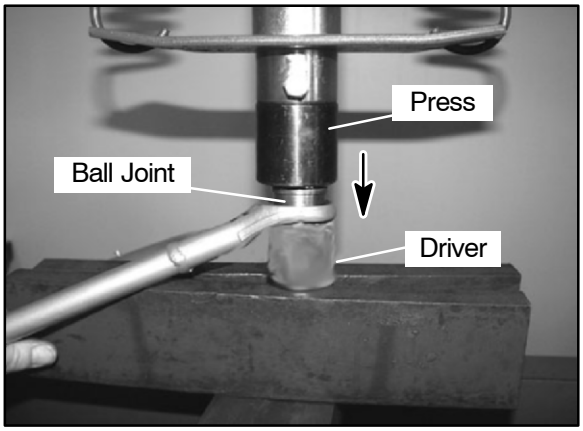




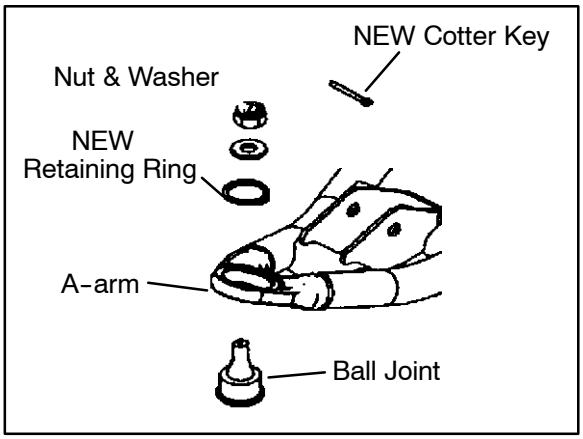
Ball Joint Installation

5. Place the A-arm in the correct position for ball joint installation. Face the A-arm end flat on top of the driver. Carefully drive the ball joint into place until the ball joint is properly installed.

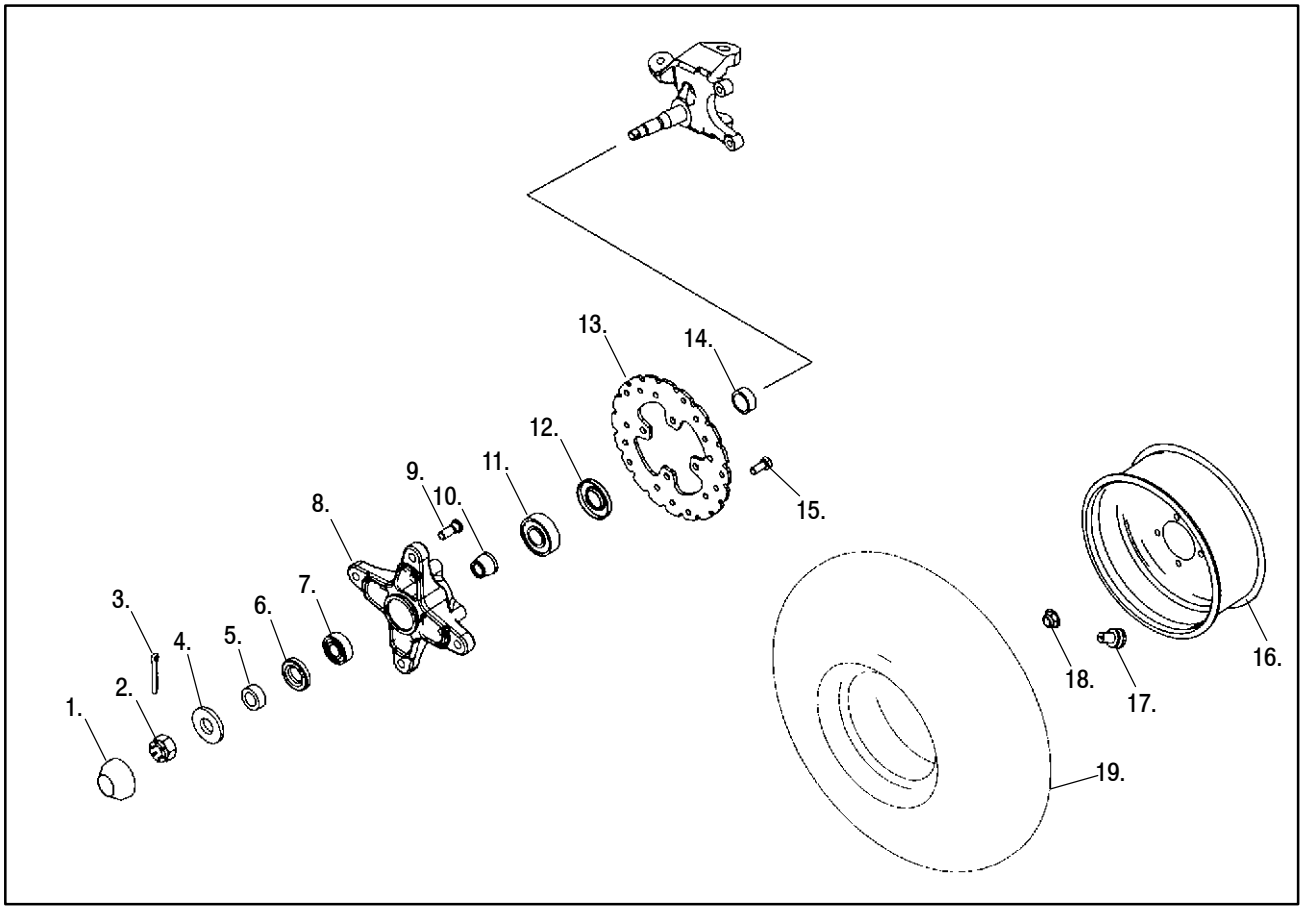




6. After the new ball joint is installed into the A-arm, install a NEW retaining ring. Upon A-arm installation onto the steering knuckle, install a NEW cotter key also.



FRONT HUB EXPLODED VIEW



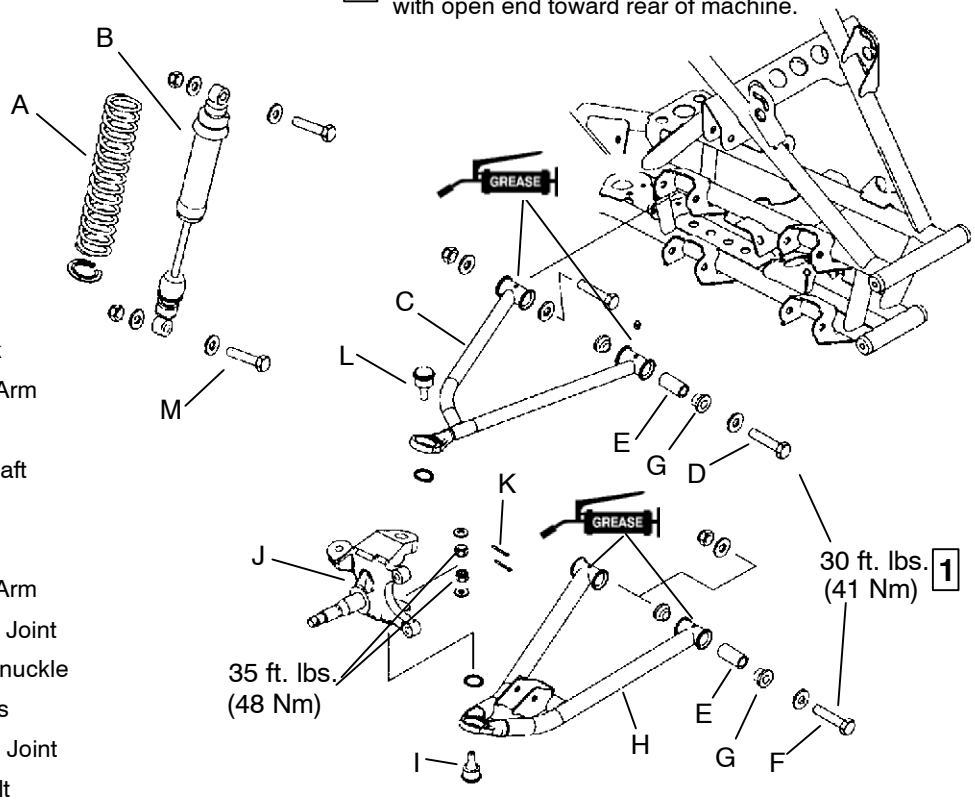
Ref. Qty. Description

1.	2	Hub, Dust Cover
2.	2	Nut, Castle
3.	2	Pin, Cotter
4.	2	Washer
5.	2	Spacer, Outer
6.	2	Seal
7.	2	Bearing, Ball, Sealed
8.	2	Hub, Wheel, Front, Indy Red
9.	8	Stud
10.	2	Spacer, Tapered
11.	2	Bearing, Ball
12.	2	Seal
13.	2	Disc, Brake
14.	2	Spacer, Inner
15.	8	Bolt
16.	2	Rim, Front
17.	2	Valve, Rim
18.	8	Nut, Flange
19.	2	Tire, Front, 21x7-10

A-ARM REPLACEMENT

1 Use new bolts upon reassembly.

2 Use new cotter pins upon reassembly. Install with open end toward rear of machine.



A. Spring
B. IFP Shock
C. Upper A-Arm
D. Bolt
E. A-Arm Shaft
F. Bolt
G. Bushing
H. Lower A-Arm
I. Lower Ball Joint
J. Steering Knuckle
K. Cotter Pins
L. Upper Ball Joint
M. Shock Bolt

1. Elevate and safely support vehicle. Remove the front wheel(s).
2. Remove the upper and lower ball joint cotter pins (K) from the ball joint studs (I & L) at wheel end of A-arm. Remove the ball joint nuts until the nuts are flush with end of the ball joints studs.
3. Push up on the upper A-arm (C) to remove the A-arm from the steering knuckle (J). Push down on the lower A-arm (H) to remove the A-arm from the steering knuckle (J).
4. Remove the lower shock bolt (M) from the lower A-arm and remove the shock from the A-arm.
5. Loosen two bolts on the A-arm tube (D) (upper and lower A-arms) by alternating each about 1/3 of the way until A-arm can be removed.

⚠ WARNING

The patch lock on the existing bolts were destroyed during removal. **DO NOT** reuse old bolts. Serious injury or death could result if fasteners come loose during operation.

6. Examine the A-arm shafts (E). Replace if worn. Discard hardware.
7. Insert A-arm shaft (E) into the new A-arm (C & H).
8. Install new A-arm assembly onto vehicle frame (upper and lower). Torque **new** bolts to **30 ft. lbs. (41 Nm)**.
9. Attach upper A-arm (C) and lower A-arm (H) to steering knuckle (J). Tighten both ball joint nuts to **35 ft. lbs. (48 Nm)**. If cotter pin holes are not aligned, tighten nut slightly to align. Install a new cotter pin with open ends toward rear of machine (upper and lower). Bend both ends in opposite directions around nut.
10. Locate four grease fittings at the end of each A-arm tube and pump A-arm ends full of grease.

⚠ WARNING

Upon A-arm installation completion, test vehicle at low speeds before putting into regular service.

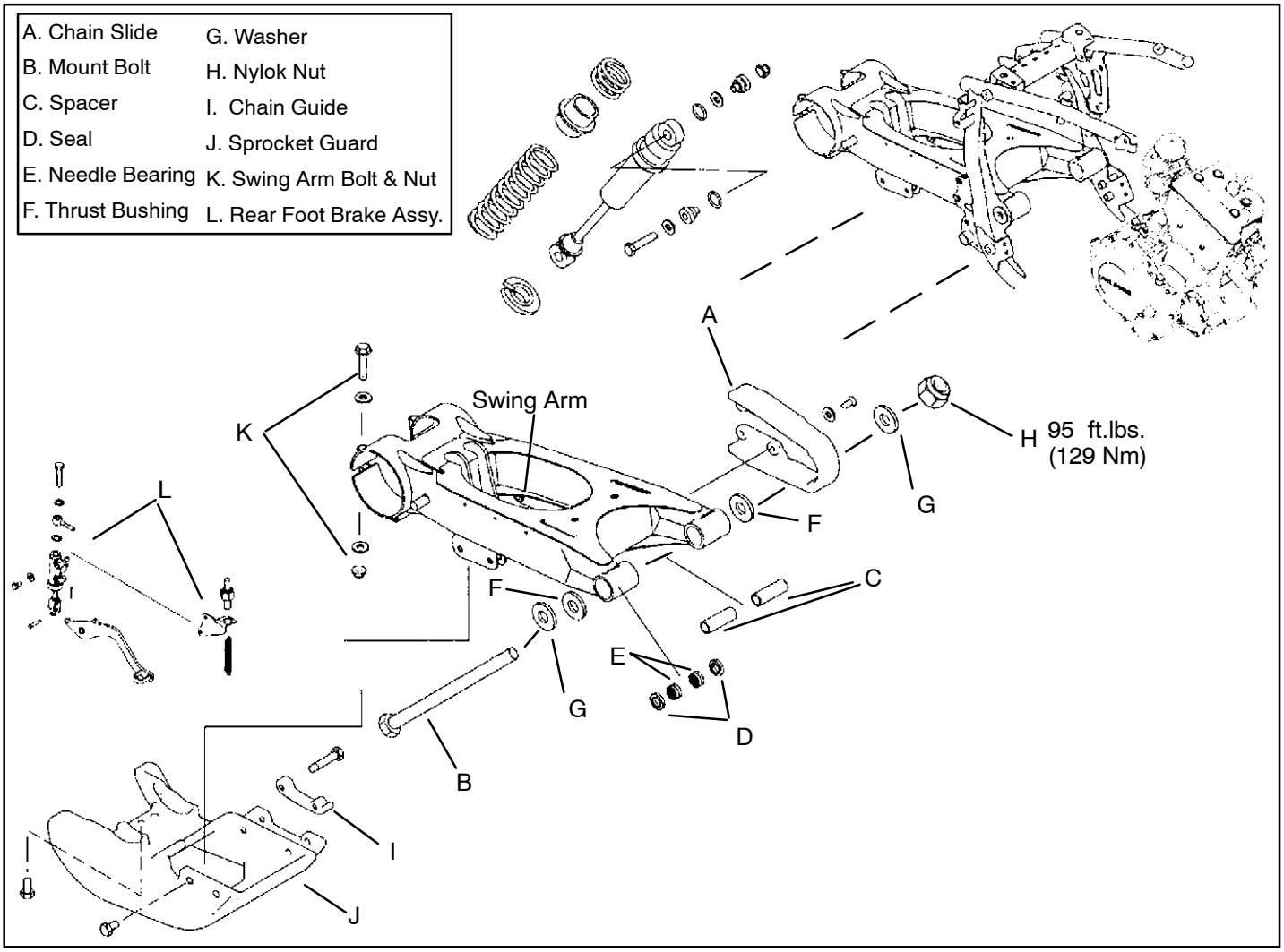
A-arm Attaching Bolt Torque:

30 ft. lbs. (41 Nm)

Ball Joint Stud Nut Torque:

25 ft. lbs. (35 Nm)

CONCENTRIC SWING ARM REMOVAL



Removal / Disassembly

1. Safely support the rear of the machine under the main frame. Remove both rear wheels.

2. Remove drive chain.

3. Remove rear caliper.

Do not allow the caliper to hang by the brake line. Brake line damage may result.

4. Remove rear wheels and/or hubs.

5. Remove lower shock bolt.

6. Remove the foot brake assembly.

7. Remove the nylok nut (H) and washers (G) from the mount bolt (B).

8. Remove the mount bolt (B) from the swing arm. NOTE: Be careful not to damage the seals (D) and bearings (E) during swingarm removal.

9. Remove swingarm from the frame.

10. If needed, remove the thrust bushing (F) and swingarm seal (D) from swingarm.

11. If needed, remove the roller bearings from the swingarm (E).

12. Clean and inspect parts for wear. Replace worn parts.

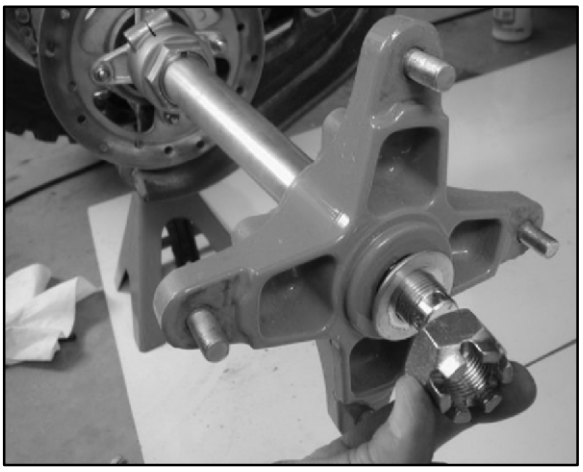
Installation

1. Reverse the steps above in the Removal/Disassembly procedure.

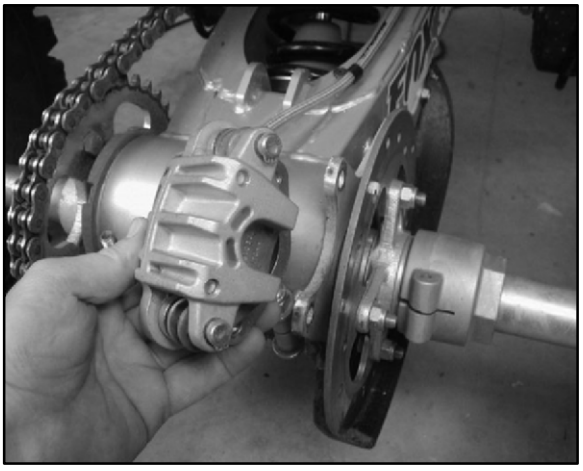
2. Torque the mount bolt (H) to **95 ft.lbs. (129 Nm**).

REAR AXLE REMOVAL/DISASSEMBLY

1. Securely support rear of machine with rear wheels off the floor. Remove rear wheels and hubs.

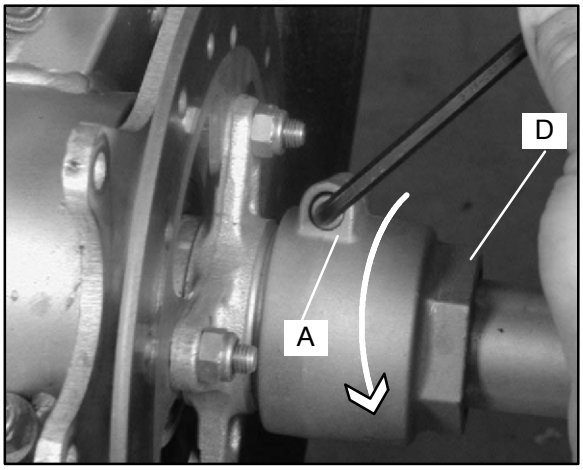


2. Remove the brake caliper bolts and remove the brake caliper.

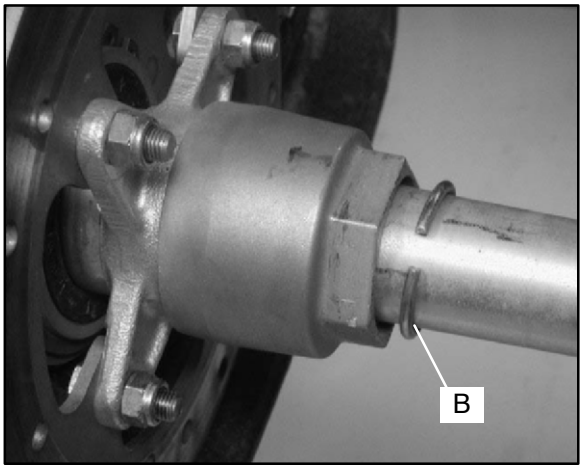


3. Remove the master link from the drive chain. Remove the drive chain.

4. Loosen the hex screw (A) to loosen the axle nut. Turn the axle nut (D) counter clockwise with a 1 3/4" Wrench (**PN 2870772**) until the retaining ring is visible for removal.

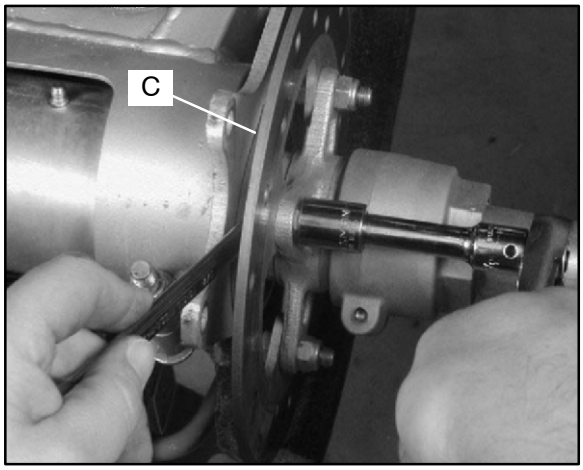


5. Remove retaining ring (B) from next to the axle nut.

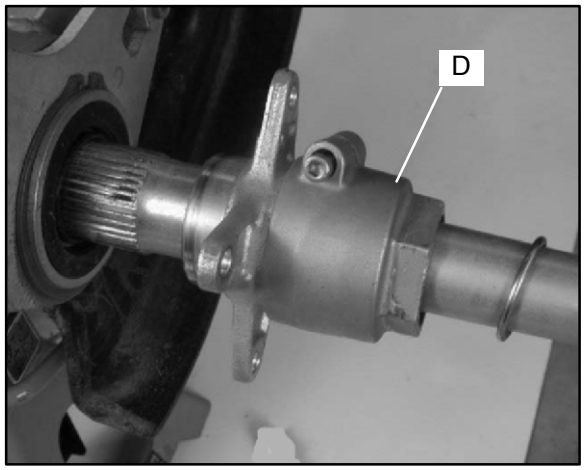


6. Remove the four bolts that secure the brake disc (C) to the rear disc hub and remove the brake disc.

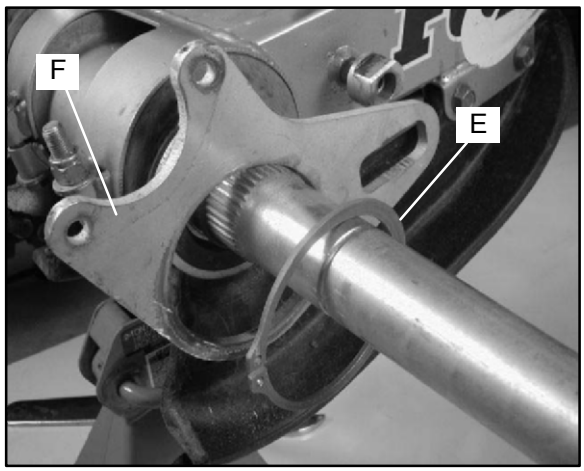
NOTE: It is not necessary to remove the brake disc at this time, only remove it if needed.



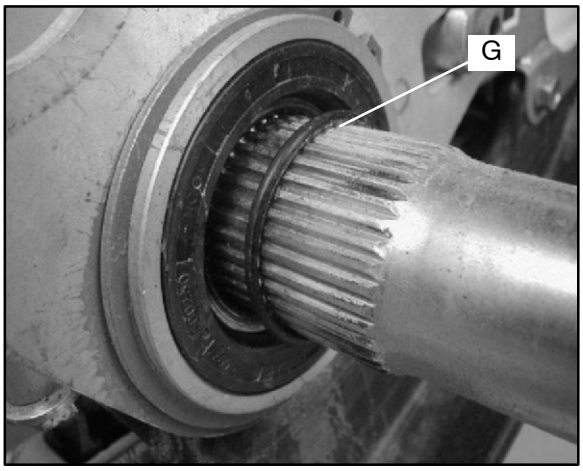
7. Loosen and remove the axle nut (D) with a 1 3/4" Wrench (**PN 2870772**).



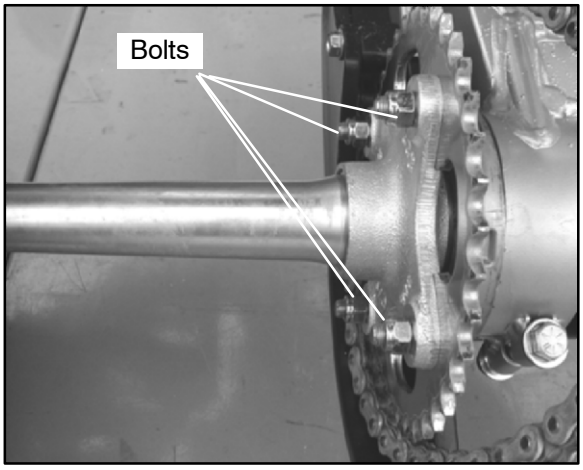
8. Remove the retaining ring (E) and caliper mounting bracket (F).



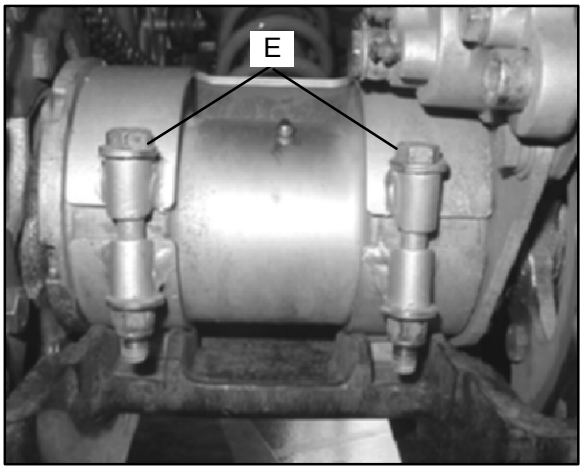
9. Remove the O-ring (G) from the axle assembly.



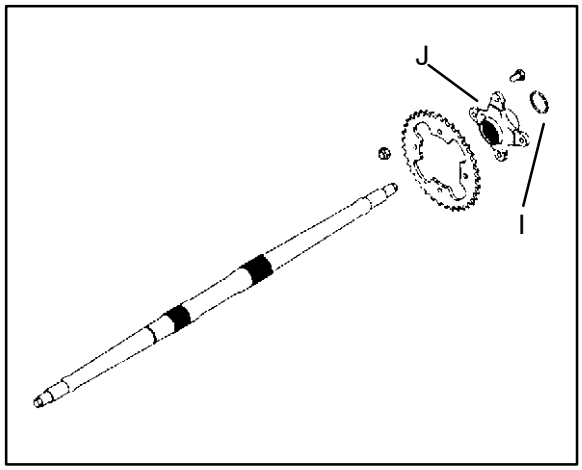
10. Remove the four bolts that secure the sprocket.



11. Slide the sprocket off the axle, if needed. NOTE: Only remove sprocket if replacing with new sprocket.
12. Loosen the concentric clamp bolts (H). Slide the axle through the rear axle housing on the sprocket side.

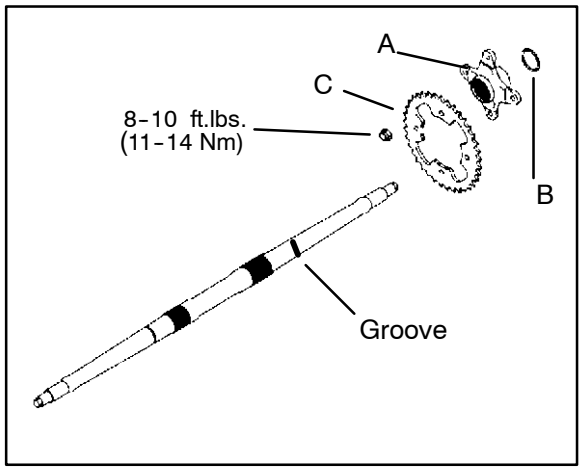


13. With the axle out, remove the retaining ring (I) and sprocket hub (J) from the axle.

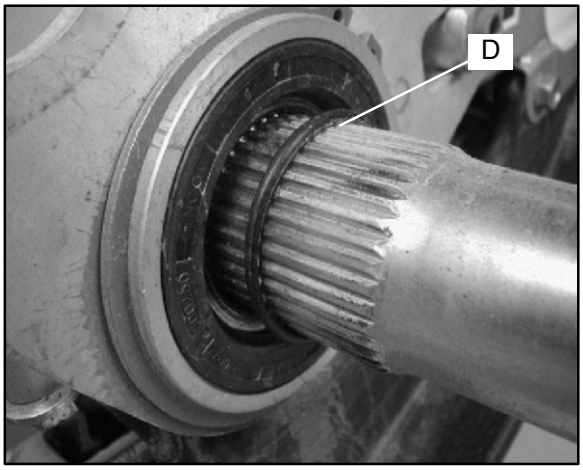


REAR AXLE INSTALLATION / ASSEMBLY

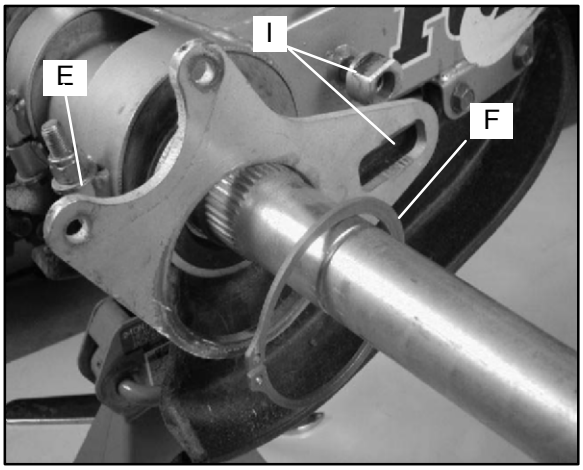
1. Slide the sprocket hub (A) onto the sprocket side of the axle. Install the retaining ring (B) onto the axle and into the groove of the axle. Apply Never Seize to the splines of the axle.



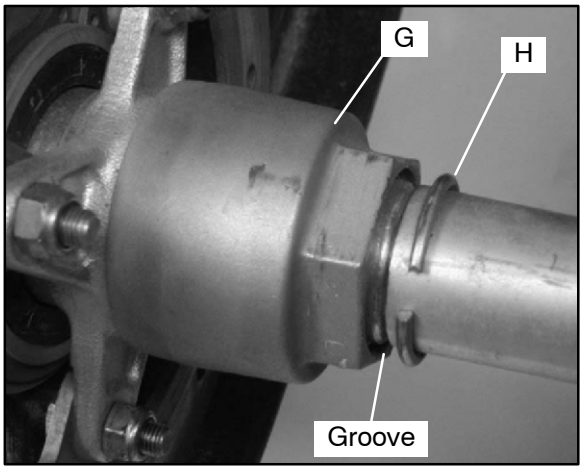
2. Slide the axle into the rear axle housing.
3. Install the sprocket (C) onto the sprocket hub (A). Torque the four sprockets nuts to **29-35 ft.lbs. (39-47 Nm)**.
4. Apply grease to the O-ring (D) and install the O-ring on the sprocket side of the axle. Install the axle through the housing. Install the O-ring into the axle housing on the brake side.



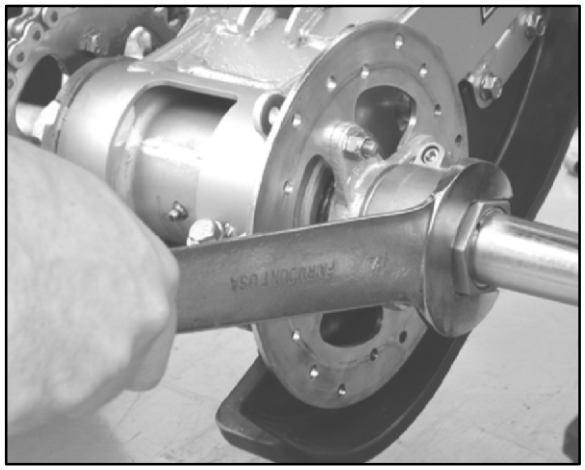
5. Install the mounting bracket (E) and retaining ring (F). Be sure to properly align the bracket (E) and bushing (I) upon installation.



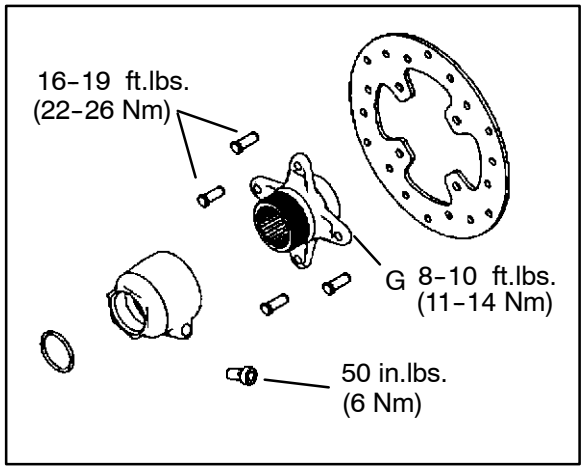
6. Install the axle nut (G) and retaining ring (H). Thread the axle nut onto the axle until there is enough room to install the retaining ring into the groove in the axle.



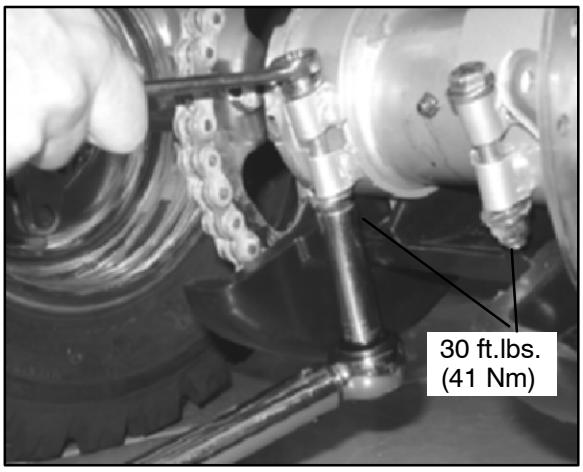
7. Turn the axle nut (G) outward with the 1 3/4" Wrench (**PN 2870772**) until the end of the axle nut (G) just covers the retaining ring (H). The retaining ring should still be visible under the axle nut from an angle.



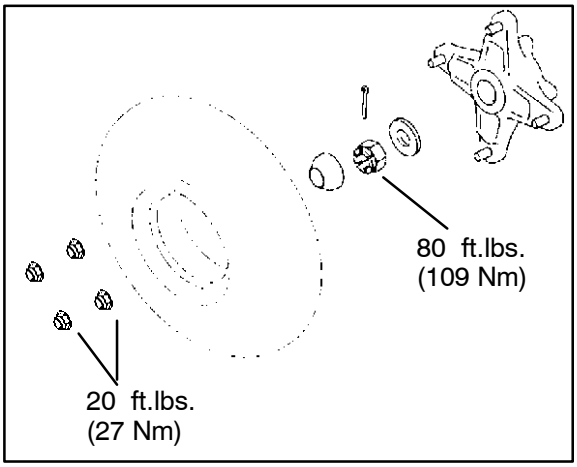
8. Torque the axle nut (G) hex bolt to **8-10 ft.lbs. (11-14 Nm)**.



9. Install the brake disc if previously removed. Torque the brake disc nuts to **16-19 ft. lbs. (22-26 Nm)**. Torque the hex pinch bolt to **50 in.lbs. (6 Nm)**.
10. Reinstall the chain and masterlink. To verify proper chain tension, refer to Chapter 2, page 2.25 for this procedure. Torque the two eccentric clamp bolts to **30 ft.lbs. (41 Nm)**.



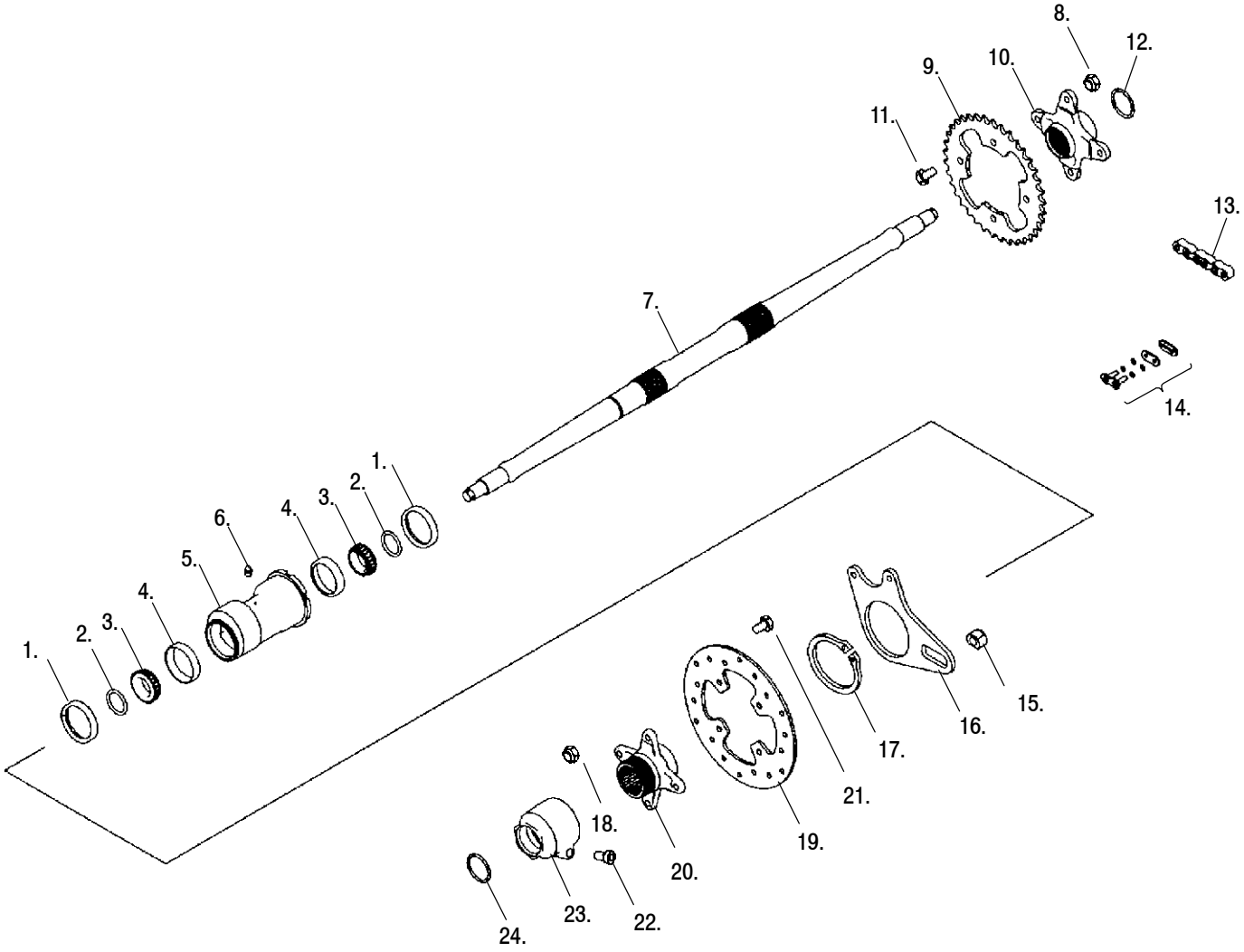
11. Install the brake caliper and torque the mounting bolts to **18 ft. lbs. (25 Nm)**.
12. Apply Anti-Seize lubricant to the axle splines. Install the rear wheel hubs on both sides. Torque the wheel hub nuts to **80 ft. lbs. (109 Nm).** Install a new cotter pin.
13. Install the rear wheels and torque wheel nuts to **20 ft. lbs. (27 Nm)**.



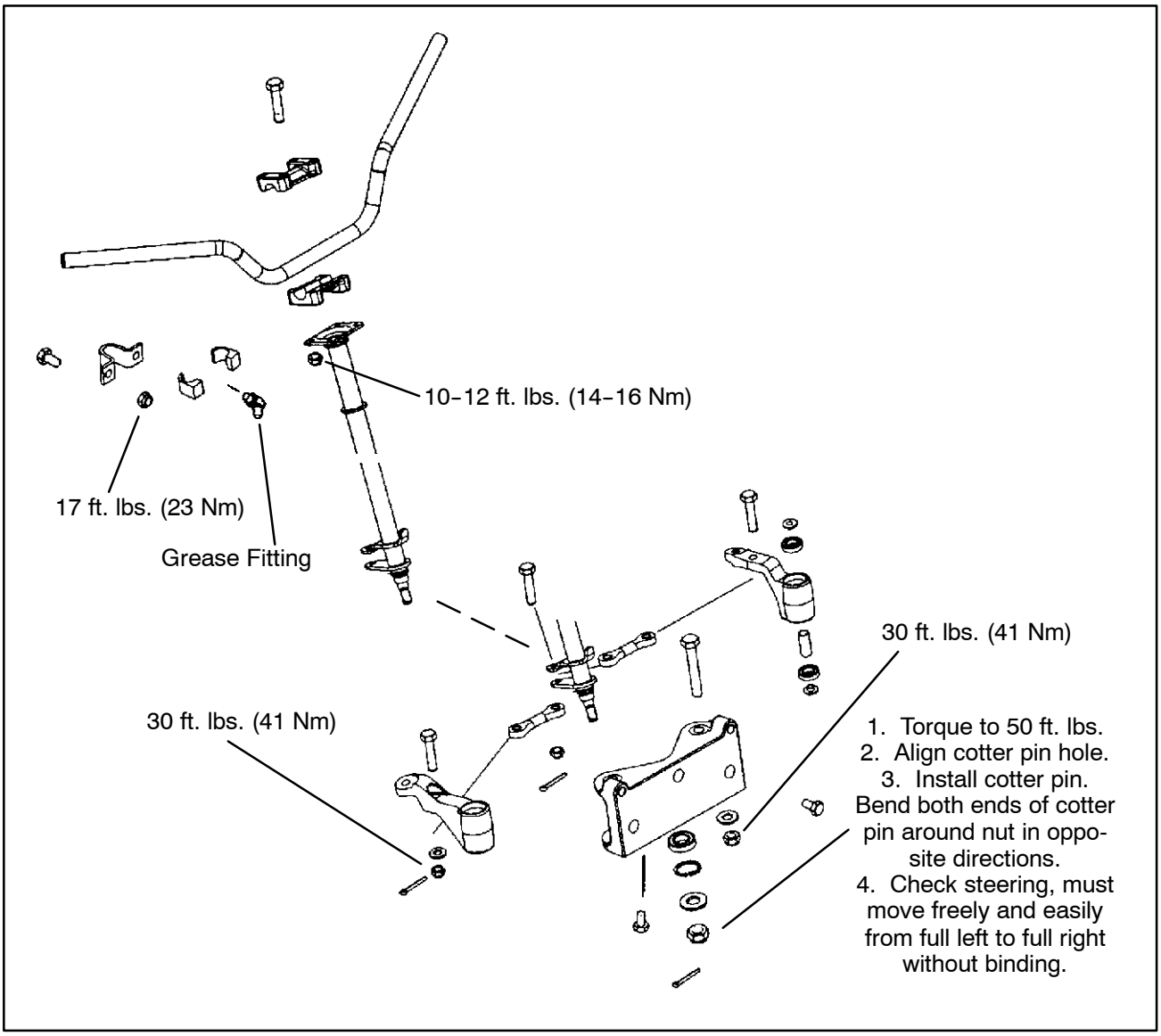
14. Lubricate the axle housing through the grease fitting with Polaris All Season Grease (**PN 2871423**).

REAR SWING ARM / AXLE EXPLODED VIEW

Ref	Qty	Desciption
1.	2	Seal
2.	2	O-Ring
3.	2	Bearing, Cone, Taper
4.	2	Bearing, Cup, Taper
5.	1	Housing, Axle, Rear
6.	1	Fitting, Lubrication
7.	1	Axle, Rear
8.	4	Nut, Nylok
9.	1	Sprocket
10.	1	Hub, Sprocket
11.	4	Bolt
12.	1	Ring, Retaining
13.	1	Chain, 94P
14.	1	Link, Connector
15.	1	Bushing, Caliper
16.	1	Bracket, Caliper Mount
17.	1	Ring, External
18.	4	Nut, Nylok
19.	1	Disc, Brake
20.	1	Hub, Rear Disc
21.	4	Screw
22.	1	Screw
23.	1	Nut, Axle
24.	1	Ring, Retaining



STEERING POST ASSEMBLY



DECAL REPLACEMENT

⚠ WARNING

The following procedure involves the use of an open flame. Perform this procedure in a well ventilated area, away from gasoline or other flammable materials. Be sure the area to be flame treated is clean and free of gasoline or flammable residue.

The side panels, front and rear fender cabs are plastic polyethylene material. Therefore, they must be "flame treated" prior to installing a decal to ensure good adhesion. A bonus of the flame treating procedure is it can be used to reduce or eliminate the whitish stress marks that are sometimes left after a fender or cab is bent, flexed, or damaged.

To flame treat the decal area:

1. Pass the flame of a propane torch back and forth quickly over the area where the decal is to be applied until the surface appears slightly glossy. This should occur after just a few seconds of flame treating. Do not hold the torch too close to the surface. (2–3 inches from the flame tip is recommended) Keep the torch moving to prevent damage.
2. Apply the decal on one edge first. Slowly lay down remainder of the decal while rubbing lightly over the decal surface to eliminate any air bubbles during the application.

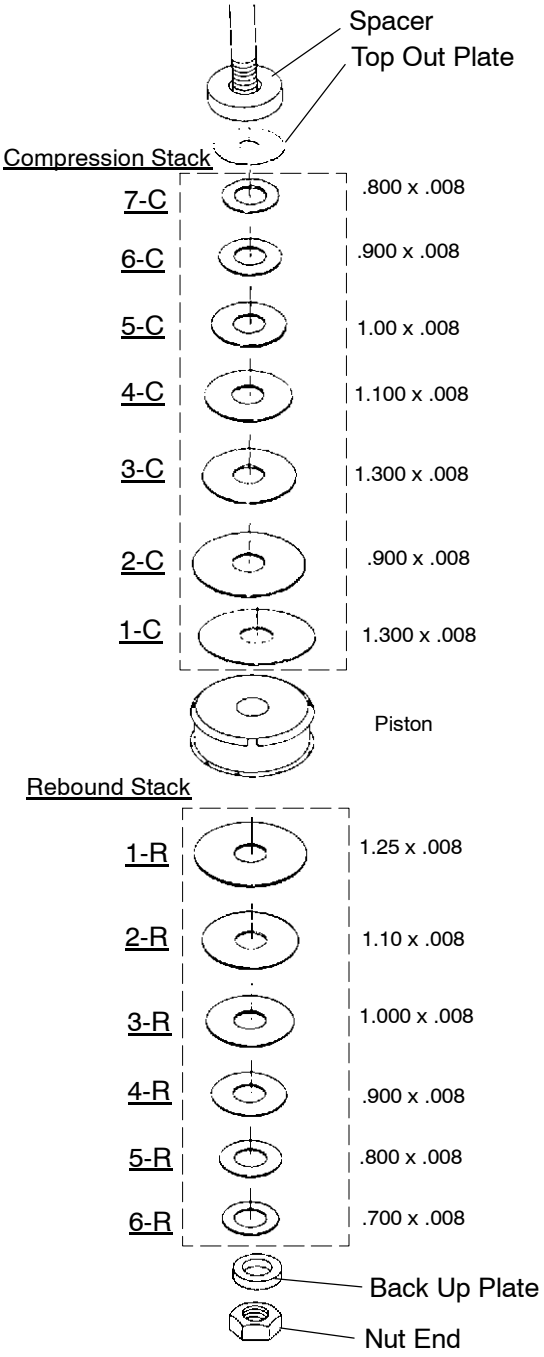
FOX™ FRONT SHOCK SERVICE

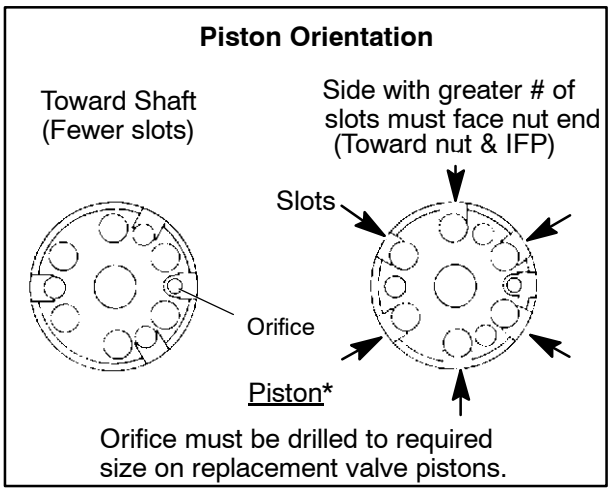
Shown below is an example of how valving stacks are arranged. The table on page 5.20 contains optional valving specifications and piston orifice sizes.

Parts in boxed area are an example of typical valving.

* Note direction of valve piston before disassembly. The side with the greater number of slots should face the IFP (nut end of the shaft).

TYPICAL VALVE STACK ARRANGEMENT





IFP Depth Adjustment For Limited Travel Setup

Spacer Thickness	IFP Depth Modifier
.25	.029 (Subtract)
.50	.058
.75	.088
1.0	.117
1.25	.146
1.50	.175
1.75	.204
2.00	.234
2.25	.263
2.50	.292
2.75	.321
3.00	.350
3.25	.380
3.50	.409
3.75	.438
4.00	.467
4.25	.496
4.50	.526
4.75	.555
5.00	.584

Spacer PN 5431355

Changing oil on Fox™ Shocks is recommended annually and should be included when performing end of season storage preparation. For competition use, shocks should be disassembled, inspected and serviced more frequently.

BODY / STEERING / SUSPENSION
Optional Valving Listed By Shock Part Number

Refer to the appropriate parts manual for a complete listing of Fox™ shock parts.

Shock Travel Limiting Spacer (1/4″) - Part Number 5431355

Valve Washer Part Numbers

Part No.	Description
1500052	1.300 x 0.006
1500050	1.250 x 0.006
1500049	1.100 x 0.006
1500048	1.000 x 0.006
1500053	0.900 x 0.006
1500054	0.800 x 0.006
1500055	0.700 x 0.006
1500030	1.300 x 0.008
1500051	1.250 x 0.008
1500031	1.100 x 0.008
1500032	1.000 x 0.008
1500033	0.900 x 0.008
1500028	0.800 x 0.008
1500029	0.700 x 0.008
1500062	1.300 x 0.010
1500026	1.250 x 0.010
1500027	1.100 x 0.010
1500045	1.000 x 0.010
1500046	0.900 x 0.010
1500047	0.800 x 0.010
1500044	0.700 x 0.010
1500079	1.300 x 0.012
1500078	1.250 x 0.012
1500060	1.100 x 0.012
1500059	1.000 x 0.012
1500058	0.900 x 0.012
1500057	0.800 x 0.012
1500056	0.700 x 0.012
1500087	1.300 x 0.015
1500086	1.250 x 0.015
1500085	1.100 x 0.015
1500084	1.000 x 0.015
1500083	0.900 x 0.015
1500082	0.800 x 0.015
1500081	0.700 x 0.015

Note: Subtract .029″ from IFP depth for each 1/4 inch spacer added to the shock damper rod for limiting.

For example: If standard (full shock travel) IFP depth is .835″, and 6 spacers are added to reduce shock travel by 1.5 inches, multiply .029 x 6 to calculate the amount to subtract from IFP depth.
Example : .835 – .174 = .661 (± .025″) New IFP Depth

Fox™ Shock Maintenance

Changing oil on Fox™ Shocks is recommended annually and should be included when performing end of season storage preparation. This oil change is necessary to avoid any chance of corrosion which could be caused by moisture contamination. For competition use, shocks should be disassembled, inspected and serviced more frequently.

When performing maintenance on Fox™ Shocks, use Gas Shock Recharging Kit (**PN 2200421**), which has the necessary valves, pressure gauge, and fittings to deflate and pressurize shocks. The Body Holder Tool, Internal Floating Piston (IFP), and Shock Rod Holding Tool are not included in the Recharging Kit and must be ordered separately. Refer to your SPX Tool Catalog for part numbers.

Gas Shock Recharging Kit

(PN 2200421)

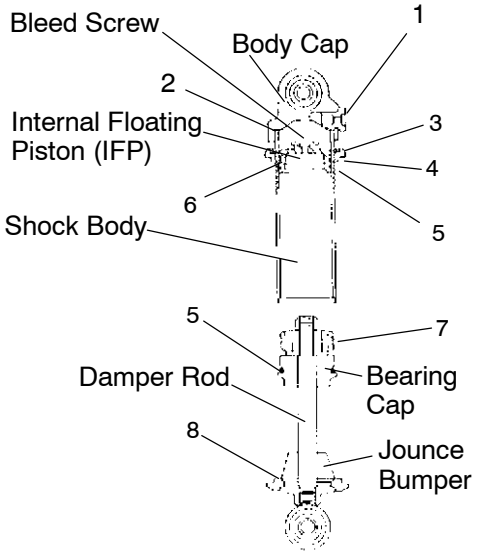
⚠ WARNING

Extreme caution should be observed while handling and working with high pressure service equipment. Wear a face shield, safety glasses, and ear protection during service of these shocks.

Care should be observed while handling the inflation needle and pressure gauges. Maintain your equipment and keep it in good condition. If injury should occur, consult a physician immediately.

Extreme cleanliness is of utmost importance during all disassembly and reassembly operations to prevent any dirt or foreign particles from getting into the shocks.

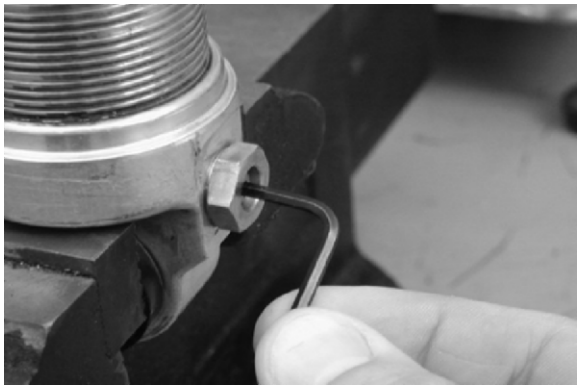
Keep the parts in order as they are disassembled. Note the direction and position of all internal parts for reassembly.



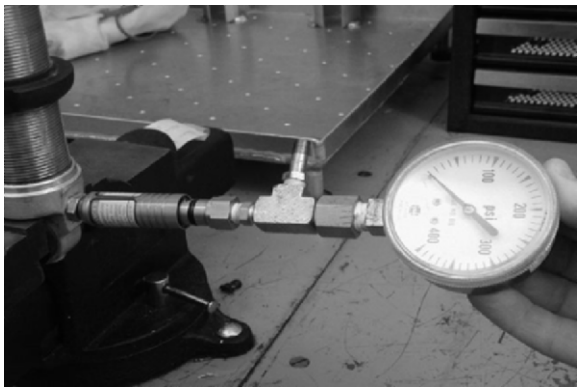
Ref. #	Qty.	Description
1	1	Pressure Valve
2	2	O-Ring
3	1	Retaining Ring
4	1	Spring Retainer Body
5	2	O-Ring
6	1	Piston Ring (Floating)
7	1	Piston Ring (Damping)
8	1	Spring Retainer, Slotted

FOX™ SHOCK DISASSEMBLY

1. Remove spring and bushings from shock eyes. Thoroughly wash shocks in a parts washer or with soap and water to remove dirt and other debris. Dry thoroughly with compressed air. Position and clamp body cap of shock in soft jaws (aluminum or brass) of vise. Remove Allen screw from pressure valve.



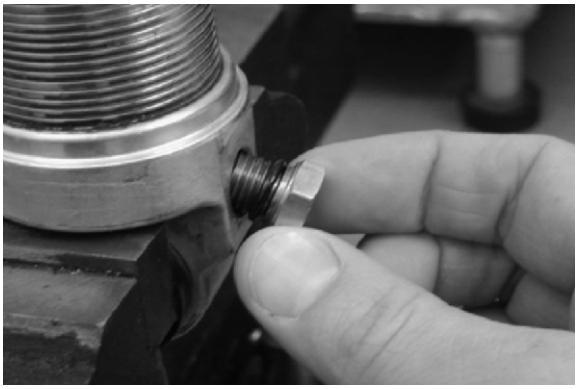
2. With valve outlet pointed in a safe direction, insert red tip of safety needle assembly into recess in shock pressure valve. Depress safety pin on safety needle and push gauge and needle assembly slowly toward shock, inserting needle. Be sure to push needle completely into shock valve. Release nitrogen in a safe direction by turning T-handle clockwise (if equipped) or by depressing Schrader valve pin.



CAUTION:

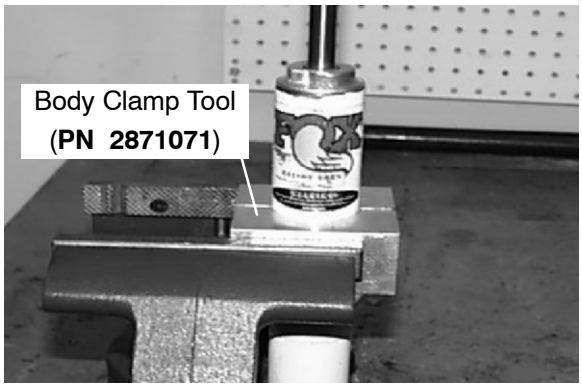
It is possible for some residual pressure to remain in the shock regardless of the gauge reading. *Always* completely remove valve from body cap before further disassembly of shock.

3. Remove valve and sealing O-ring from body cap.



4. Extend shock shaft by pulling up on shock eyelet. Using a 1″ (25 mm) or adjustable wrench, loosen shaft bearing cap.

5. IIf body of shock starts to unscrew from body, tighten and try again. To keep body from turning, it may be necessary to use Body Clamp Tool clamped lightly around body in soft jaws of vise.



Shock Body Clamp Tool

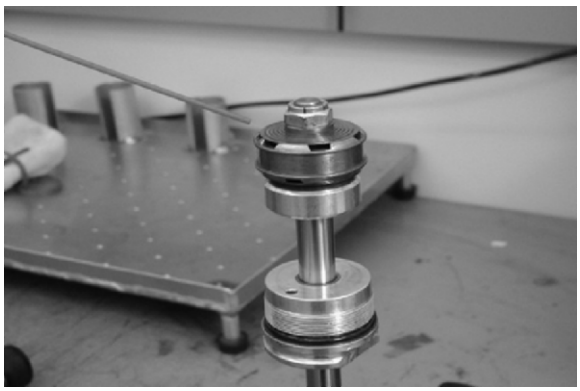
(PN 2871071)

NOTE: Position body clamp at least 1 1/2″ below bearing cap.

6. Pull shock rod and piston straight out to avoid seal or valve damage. Be prepared to catch piston ring when removing the damper rod/valve piston.

7. Remove shock from vise and dispose of used oil properly. Set shock body aside.

8. Mount damper rod in soft-jawed vise. Loosen valve nut and clean the valve piston and valving washers with electrical contact cleaner. Dry thoroughly with compressed air. Tighten nut and torque to **12 ft. lbs. (17 Nm)**.



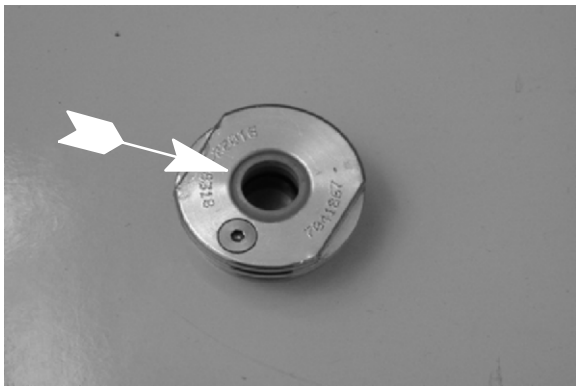
Valve Nut Torque

12 ft. lbs. (17 Nm)

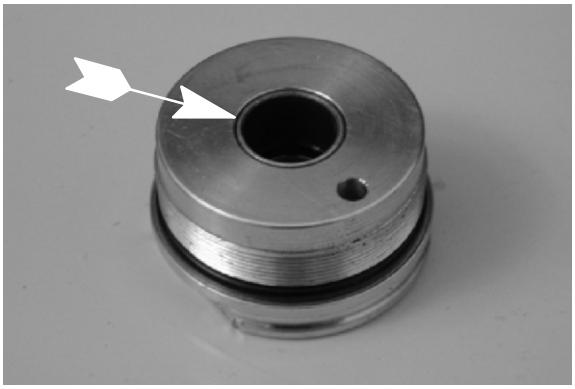
9. If bearing cap and/or seals are to be replaced, remove nut, washer, and valve piston with valving washers and set aside. Keep washers in order and note orientation of slots in piston for proper re-installation. The side with the greater number of slots must face the damper rod nut (toward IFP).

SEAL REPLACEMENT

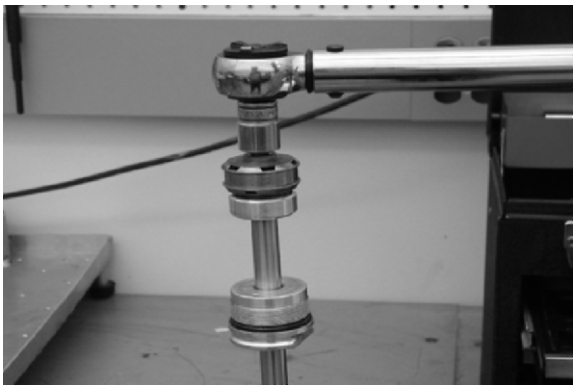
1. Remove bearing cap from damper rod. Inspect seals, o-ring, and bushing inside cap. Inspect cap O-ring and replace if torn or damaged.
2. Using a small screwdriver or scribe pry upper seal, main seal, and O-ring out of bearing cap. Use care to avoid scratching the seal cavity.



3. Clean seal cavity and inspect bushing for wear or damage and replace bearing cap if necessary.



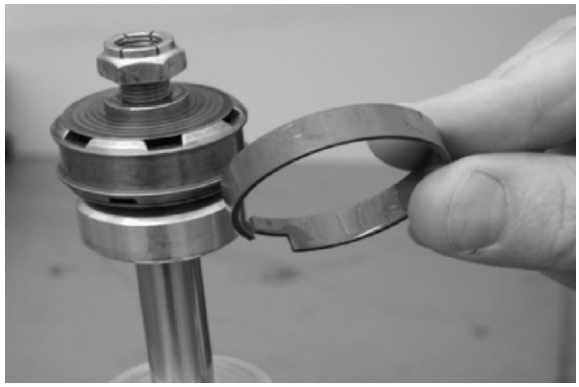
4. Lubricate new seals and O-ring with Polaris shock oil and install. Be sure the seals are seated completely in the seal cavity.
5. Inspect jounce bumper (where applicable) and replace if damaged.
6. Inspect damper rod for nicks, scratches or abrasion. Install bearing cap and thick backing washer on damper rod. Install compression valve washer stack in same order as disassembly. Install valve piston with greater number of slots facing damper rod nut (toward IFP). Install rebound stack, washer, and a new nut. Torque nut to **12 ft. lbs. (17 Nm)**.



Valve Nut Torque

12 ft. lbs. (17 Nm)

7. Inspect valve piston ring for wear. The outer surface of the ring should be even in color. Set aside damper rod assembly for reinstallation.



8. Position shock in vise with Body Clamp Tool . Clean body clamp tool before installing.

Shock Body Clamp Tool

(PN 2871071)

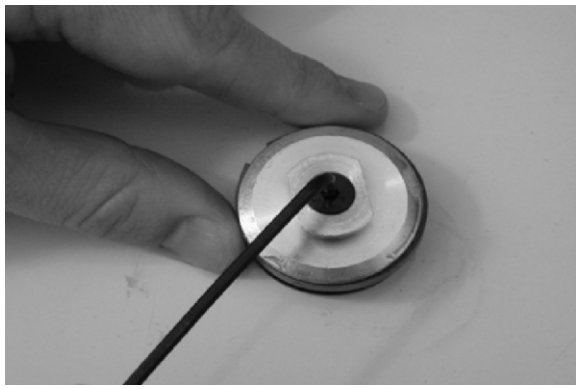
9. Using an open end or large adjustable wrench, unscrew the body cap from the body.
10. Inspect O-ring in body cap for damage.

11. Note location of Allen screw in internal floating piston (IFP) for reassembly in body tube. Remove IFP through bottom body cap end (external threaded end) using IFP tool. Be prepared to catch piston ring and piston as it comes out. Remove Allen screw from center of piston. Inspect bleeder screw O-ring and IFP sealing O-ring for wear or damage. Replace O-rings upon reassembly.

12. Carefully clean *all* parts thoroughly with electrical contact cleaner or solvent and dry with compressed air. Inspect shock body for scratches or wear.

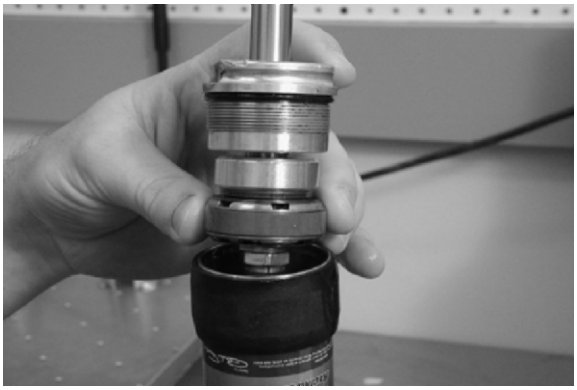
REASSEMBLY

1. Install bleeder screw in IFP until O-ring is lightly seated.



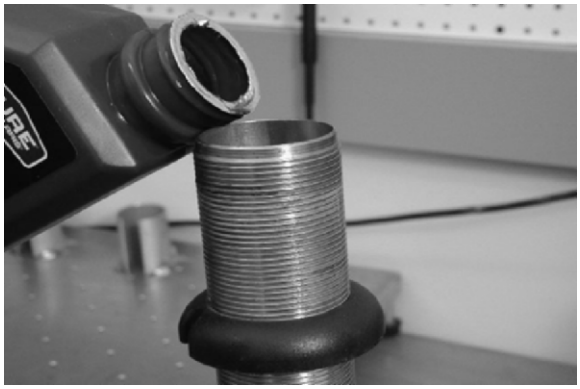
NOTE: Bleeder screw must be positioned toward body cap (externally threaded) end of shock body.

2. Compress flexible piston ring around valve piston and install piston into shock body.



3. Screw in bearing cap by hand until O-ring is fully seated.

4. Invert shock and mount bearing cap flats lightly in vise. **Caution:** Verify damper rod is fully extended.
5. Fill with shock fluid to approximately 1″ (2.54cm) from end of body.



6. Insert IFP.

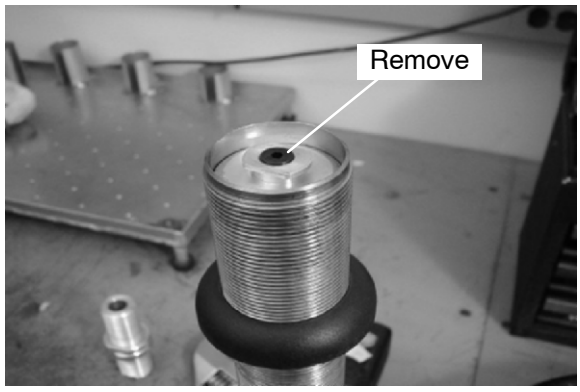
7. Install body cap until O-ring is lightly seated.
8. Mount shock in vise by top eyelet as shown. Support shock and strike body cap end 2-3 times with a soft faced hammer to remove all air trapped inside the valve piston. Allow shock to stand for 3-5 minutes.

CAUTION:

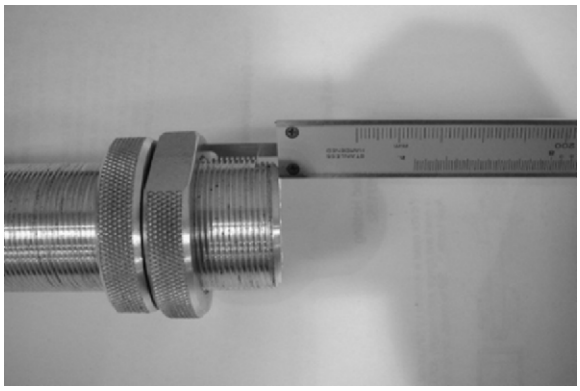
Do not over-tighten vise or bearing cap may be damaged.

9. Unscrew body cap and remove.

10. Remove IFP bleeder screw.

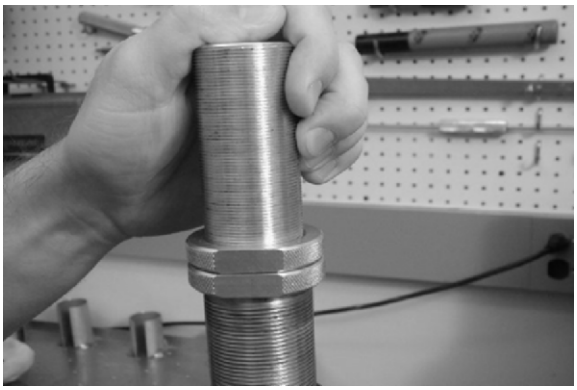


11. Set IFP tool to specified depth with a dial caliper as shown.



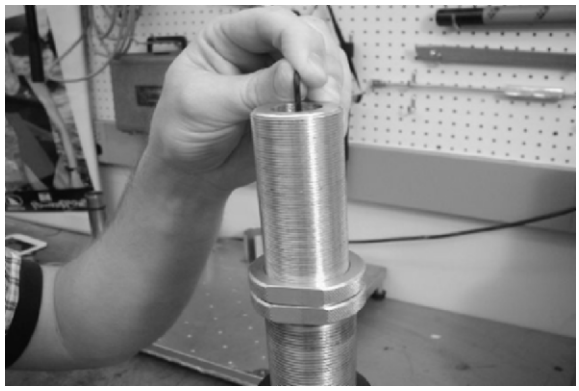
IFP Tool: (PN 2871351)

12. Insert IFP tool and slowly push IFP to specified depth. Place a shop towel over the end of IFP tool to catch any spilled shock oil.



13. With the IFP set and the bleeder screw removed, slowly stroke shock to force air through piston oriface. Move the shock body slowly to prevent aeration of the oil. Allow all air to purge through the bleeder screw hole.

14. Install the bleeder screw with a new O-ring and tighten securely, using the flats on the tool to prevent the IFP from turning. Pour out excess oil. It is not necessary to completely clean all oil from the nitrogen chamber, a small amount of oil will lubricate the IFP. Verify the proper IFP depth to within ± .025″ (.63mm) with a dial caliper. Be sure to measure to the flat portion of the IFP, not to the tapered outer edge.



15. Reinstall body cap with a new O-ring and tighten by hand. Mount shock with body cap end down in the soft jaws of a vise. Torque bearing cap to 8-10 ft. lbs. (11-14 Nm). This will also tighten the body into the body cap.

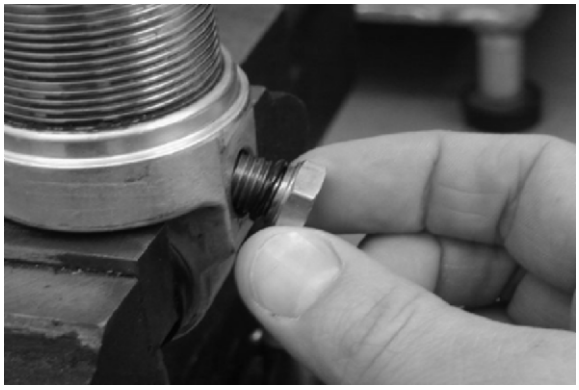
CAUTION:

Do not over tighten or damage to the bearing may result.

Bearing Cap Torque

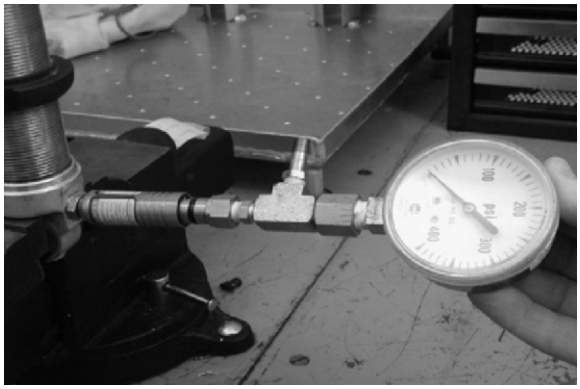
8-10 ft. lbs. (11-14 Nm)

16. Install pressurizing valve with new O-ring and tighten securely.

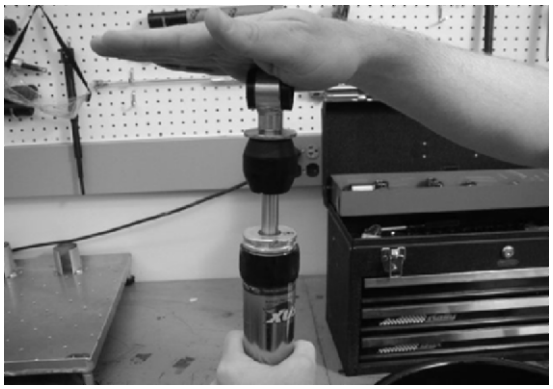


17. Set the nitrogen tank pressure regulator to 200 - 205 PSI.

18. Insert the Fox™ Charging Needle (**PN 7052069**) and charge with nitrogen to 200 PSI. Pull the needle straight outward and remove from the pressurizing valve while holding the pressure hose on the fitting. Do not insert the needle again to check pressure as the volume inside the gauge will reduce pressure in the shock.

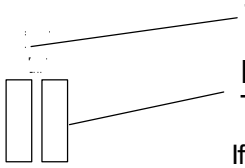


19. As a final check, push the damper rod through a full stroke. The damper rod must bottom out at full travel, and then slowly rise to full extension. Shaft movement must be smooth and consistent throughout the entire compression and rebound stroke, without binding or loss of damping.

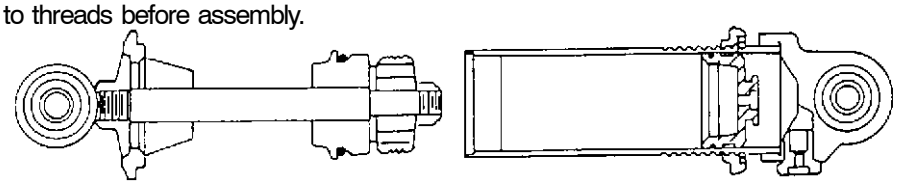


20. To check for leaks, submerge the shock in water and look for bubbles or oil seepage around the bearing and body caps.
21. When reinstalling shocks on the machine, torque only to required specifications. If the shock is over tightened it will not pivot, possibly resulting in damage to shaft and seals.
22. When installing IFS shocks, tighten top mount first. Pivot shock body into lower mount and determine if spacer washers are necessary to prevent twist or side loading of shock. Suspension assemblies should always be moved through entire travel without springs to verify free movement and proper alignment of all components.

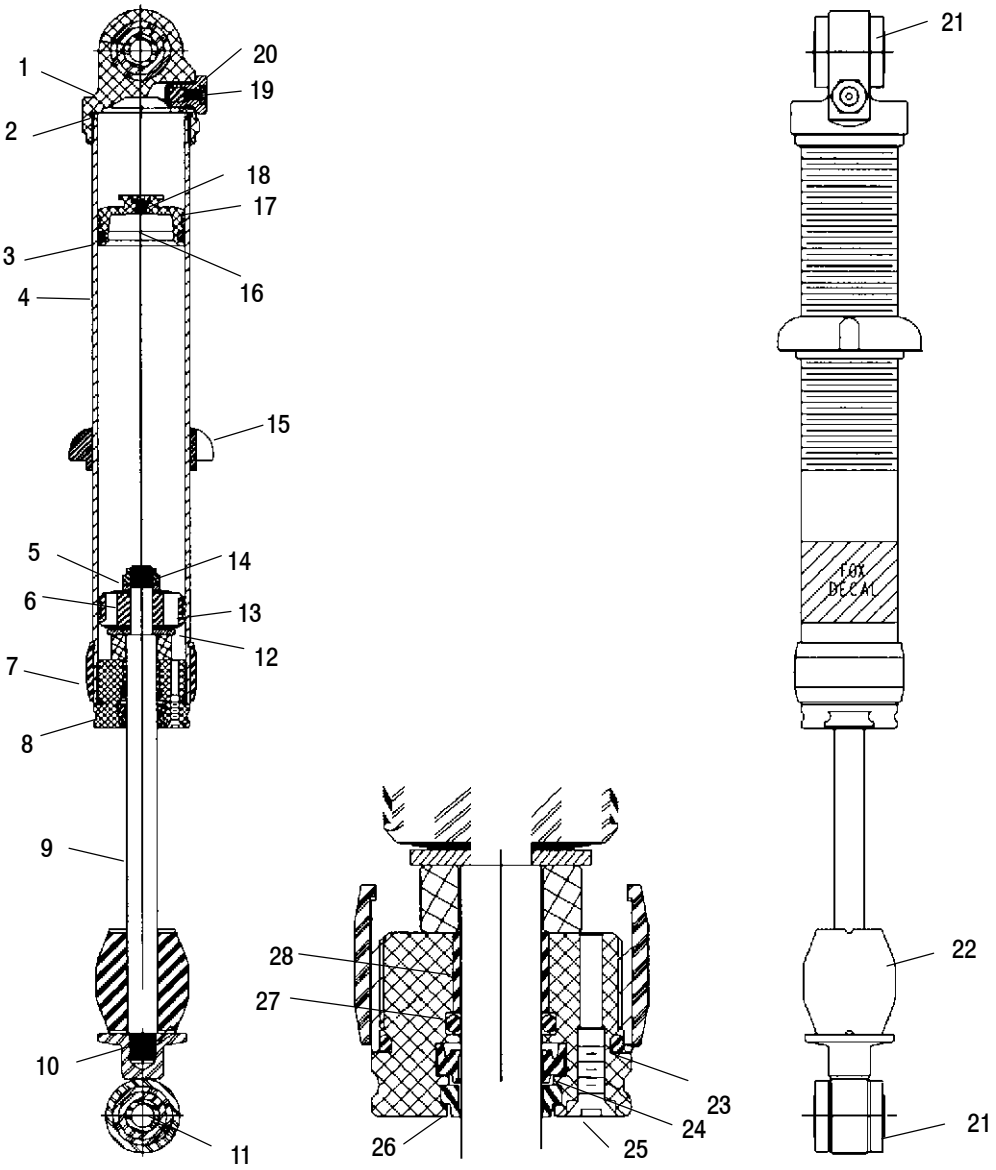
SHOCK EYELET REPLACEMENT



If shock eyelet is removed for damper rod replacement, clean threads of eyelet and damper rod thoroughly with Loctite™ Primer N. Apply Loctite™ 262 to threads before assembly.



FOX™ FRONT SHOCK EXPLODED VIEW



Ref.	Qty	Description	Ref.	Qty	Description
			15.	1	Nylon Preload Ring
1.	1	Body Cap	16.	1	Floating Piston
2.	1	O-Ring	17.	1	External Bearing
3.	1	O-Ring	18.	1	Screw, O-ring
4.	1	Body	19.	1	Screw
5.	1	Back Up Plate	20.	4	Air Valve
6.	1	Piston	21.	1	Bushing
7.	1	Guide Spring	22.	1	Bottom/Out Bumper
8.	1	Bearing	23.	1	O-Ring
9.	1	Shaft	24.	1	U-Cup
10.	1	Eyelet Assy.	25.	1	Screw
11.	2	Sleeve	26.	1	Wiper
12.	1	Top Out Plate	27.	1	O-Ring
13.	1	External Bearing	28.	1	Internal Bearing
14.	1	Lock Nut			

FOX™ REAR SHOCK SERVICE

When performing maintenance on Fox™ shocks, use the Gas Shock Recharging Kit (**PN 2200421**), as it contains the necessary valves, pressure gauge, and fittings to deflate and pressurize shocks.

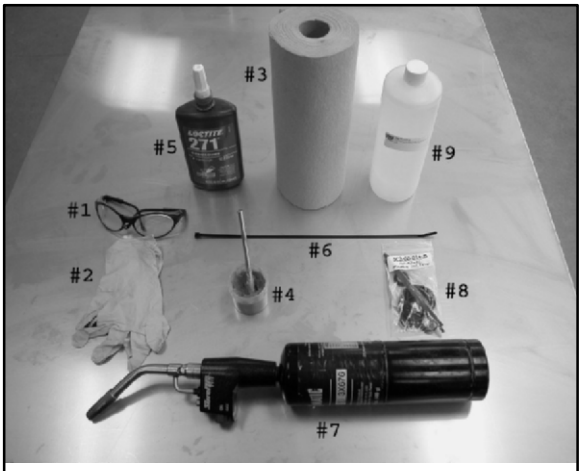
WARNING: Fox™ shocks contain high pressure nitrogen gas. Extreme caution must be used while handling and working with Fox™ shocks and related high pressure service equipment. The pressure must be released from the shock before disassembly. It is strongly recommended you wear safety glasses and ear protection during these procedures.

TIP: Extreme cleanliness is of utmost importance during all disassembly and reassembly operations. This prevents dirt or foreign particles from entering the shock which causes premature failure.

Recommended Service Intervals

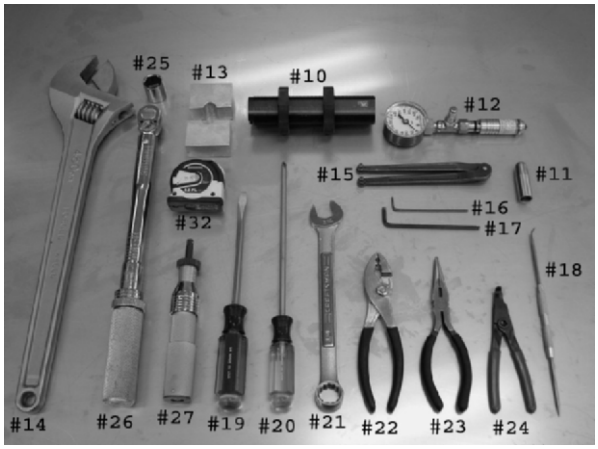
Fox™ Racing Shocks will perform the best if serviced at regular intervals:

- Every ride – Wash and dry the vehicle and suspension.
- Every 100 hours – Visually inspect shock seals
- Every 500 hours or Annually – Change shock oil and seals.



1. Safety Glasses
2. Latex Gloves
3. Lint Free Towels
4. Assembly Lube (lithium based grease)
5. Loctite #271
6. 12” Tie Wrap (Zip Tie)
7. MAPP Gas or Propane Torch
8. Fox 1.834 TC Seal Kit
9. Fox 5wt. Shock Fluid

Special Tools Required:
Body Holding Tool (**PN 2871017**)
Charging Needle (**PN 7052069**)
Gas Shock Recharging Kit (**PN 2200421**)
Fox™ Shock IFP Tool (**PN 2871351**)



10. Fox IFP Depth Setting Tool
11. Fox Seal Installation Bullet (5/8”)
12. Fox Nitrogen Safety Needle
13. 5/8” Shaft Clamps
14. Adjustable Wrench
15. Pin Spanner Wrench (3/16” Pins)
16. 3/32” Hex Key (Allen Wrench)
17. 5/32” Hex Key (Allen Wrench)
18. Scribe or Dental Pick
19. 1/4” Flat Blade Screwdriver
20. #2 Phillips Screwdriver
21. 3/4” Open End Wrench
22. Standard Pliers
23. Small Needle Nose Pliers
24. Snap Ring Pliers
25. Socket
26. Torque Wrench
27. Torque Driver
28. Soft Faced Rubber Mallet
29. Nitrogen Tank w/ Regulator
30. Cleaning Solvent
31. Vice with soft jaws
32. Tape Measure

FOX™ REAR SHOCK SERVICE

1. Read through all of these instructions first to familiarize yourself with the rebuild procedure. Make sure you have a clean work area, and all of the necessary tools are available. ***Always use proper safety equipment when working on shock absorbers.***
2. Clean the entire shock assembly with soapy water. Try to remove as much dirt and grime as possible by scrubbing with a soft bristle brush. Never pressure wash your shock, as this can force water and debris inside which will damage the seals. Dry the shock assembly with compressed air, if available, or use clean towels.
3. Measure the spring set length (Fig. 1). Record this number along with the positions of the rebound and compression adjustment knobs.

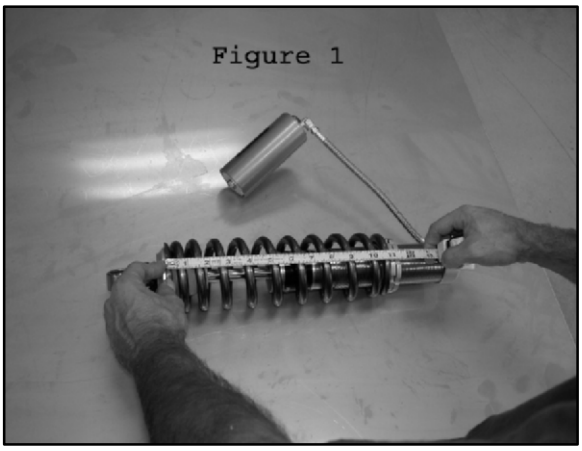


Figure 1

4. Loosen the preload lock ring, and back the preload adjustment ring off until spring is loose on the body. Remove the lower spring retainer by pushing it toward the body and removing the wire retaining ring. Slide the lower spring retainer off.
5. Remove the spring and stainless steel spring support washer.
6. Back the rebound adjustment knob out until the clicking stops. Set the compression adjustment knob to the #1 position.
7. Back the rebound adjustment knob out until the clicking stops. Set the compression adjustment knob to the #1 position.
8. Using a 3/32" Hex Key, loosen the bearing cap set screw. Use pin spanner tool to unscrew the bearing cap, and slide the bearing cap up to the bottom-out bumper. (Fig. 2) Remove shock from the vise.

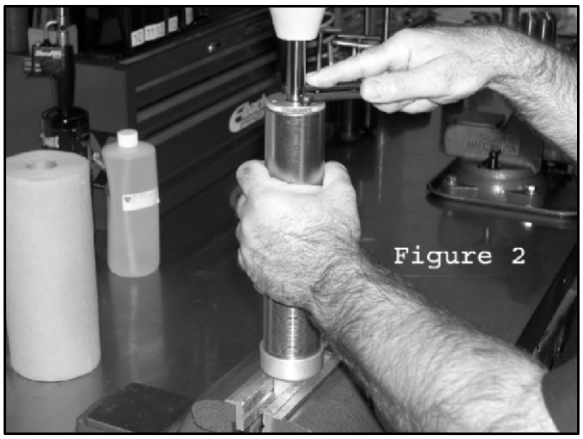


Figure 2

9. Use a 3/32" Hex Key to remove the button head screw from the air valve in the reservoir end cap.
10. Securely clamp Fox Nitrogen Safety Needle in vice. **CAUTION!** ***Point air valve away from face and body when charging or discharging any shock.***
11. Insert the Fox™ Safety Needle squarely into center of gas valve. (Fig. 3)

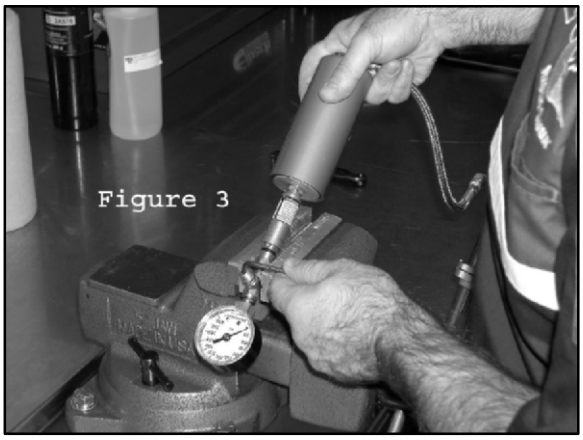
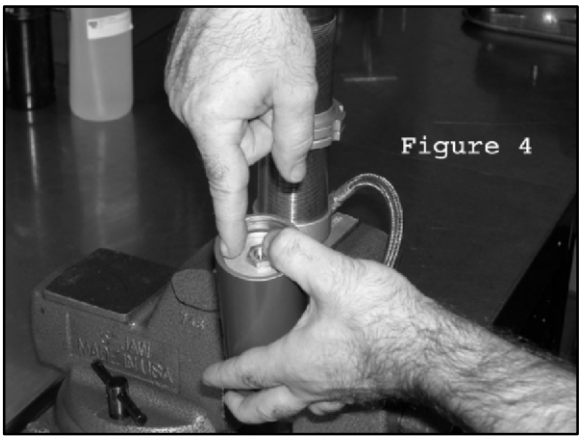


Figure 3

12. Using a blunt object, depress the air valve core to release pressure. (Fig. 3)
13. When the shock is fully discharged, pull reservoir away from the Fox™ Safety Needle in a straight, smooth motion.
14. Clamp the body cap of the shock securely in vice with shaft side up.

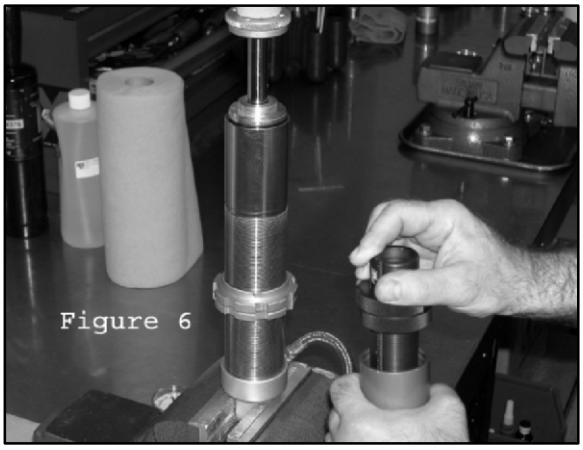
FOX™ REAR SHOCK SERVICE

15. Gently tap the reservoir end cap with a rubber mallet to expose the wire retaining ring. Locate the end of the ring and push inward with fingertip. Remove the retaining ring. A scribe or dental pick can also be used for this step, but use extreme caution not to scratch the bore of the reservoir tube. (Fig. 4)



16. Use pliers to grab flats of the gas valve of reservoir cap. Extract cap from reservoir tube using a twisting motion. Set reservoir cap aside on a clean, lint free paper towel.
17. Using your fingertips, depress the bearing into the body tube to expose the wire retaining ring. Locate the end of the ring and push inward with your fingertip. Remove retaining ring. A scribe or dental pick can also be used for this step, but use extreme caution not to scratch the bore of the body tube. (Fig. 5)

18. Align the slot of the Fox™ IFP Depth Tool (**PN 2871351**) with the end of the IFP (Internal Floating Piston). Insert the IFP tool into the reservoir and rotate 90 degrees to engage. Push the IFP Tool until the IFP bottoms out inside the reservoir. This will cause the shaft assembly to be pushed out of the body tube. (Fig. 6) Remove the shaft assembly from the body tube, and place on a clean, lint free paper towel. Remove the shock from the vise and pour shock oil from body tube into a proper disposal container. DO NOT RE-USE OLD SHOCK OIL.



19. Clamp the body cap of the shock securely in vise with the open end of the body tube.
20. Gently pull the IFP out of the reservoir tube using the IFP Depth SettingTool (Fig. 7), and place it on a clean, lint free towel. Remove the shock from the vice and pour shock oil from body and reservoir into a proper disposal container. DO NOT RE-USE OLD SHOCK OIL. Take several sheets of clean, lint free paper towels and stuff them into the body and reservoir tubes. (This prevents residual oil from dripping out of body and reservoir.)

FOX™ REAR SHOCK SERVICE

21. Remove the IFP o-ring using a scribe or dental pick. Use extreme caution not to scratch the o-ring groove. Scratching the o-ring groove will compromise the performance of your shock. Place the IFP on clean, lint free paper towel.
22. Push the compression damping (CD) housing into the reservoir tube to expose the wire retaining ring. Locate the end of the ring and push inward with fingertip. Remove retaining ring. A scribe or dental pick can also be used for this step, but use extreme caution not to scratch the bore of the reservoir tube. (Fig. 8)

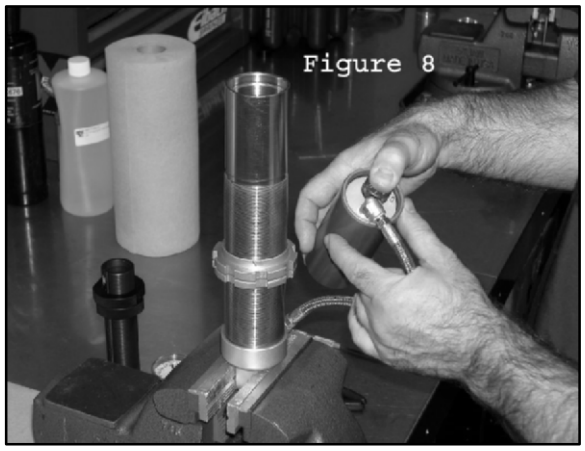


Figure 8

23. Gently pull the CD housing out of reservoir tube using a twisting motion. Do not pull directly on the hose. Place reservoir tube on clean, lint free paper towel.
24. Push the end of a 3/32" Hex Key through the small access hole in the side of the CD housing to unseat the wire retaining ring that secures the damp plate assembly. Use a pointed tool such as a scribe or dental pick to remove the retaining ring. Use extreme caution not to scratch the bore of the CD housing. (Fig. 9)

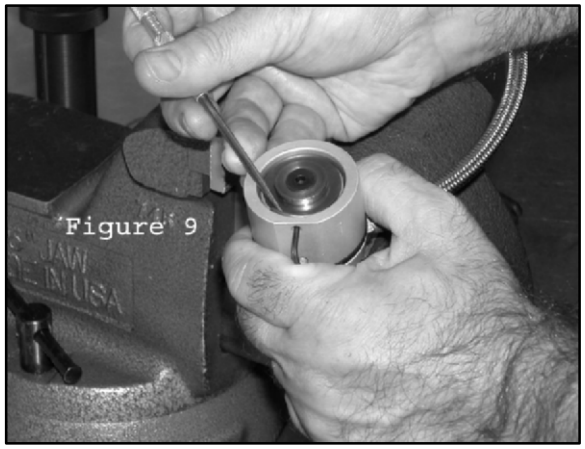


Figure 9

25. Insert a 5/32" Hex Key into the screw head of the damp plate. Remove damp plate by twisting clockwise. (Fig. 10) Place the damp plate assembly on a clean, lint free paper towel.

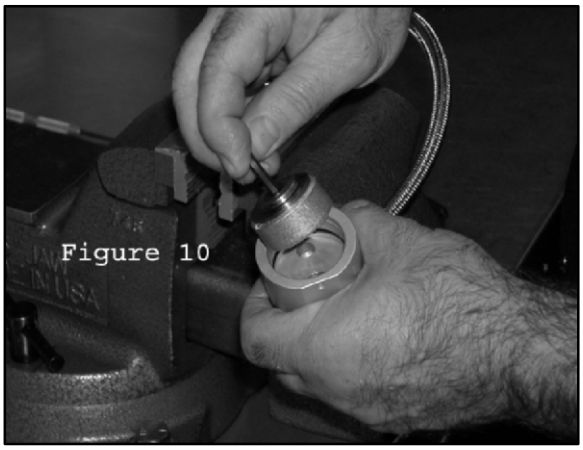


Figure 10

26. Remove damp plate sealing o-ring using a scribe or dental pick. Use extreme caution not to scratch the o-ring groove. Scratching the o-ring groove will compromise the performance of the shock.
27. Check to make sure the compression adjustment knob is set to the #1 position. Insert a 5/32" Hex Key into the largest hole in the side of the CD housing to keep the knob from turning. Use a 3/32" Hex Key to remove the screw that secures the compression adjuster knob. (Fig. 11)

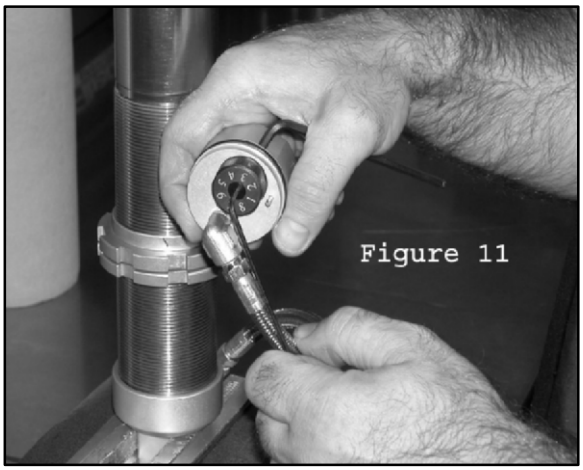


Figure 11

28. Remove the compression adjustment knob, o-ring, clicker balls (2), and springs (2).
29. Remove 5/32" Hex Key from CD housing.

FOX™ REAR SHOCK SERVICE

30. Push on the protruding adjuster drum stem to remove it from CD housing. (Fig. 12)

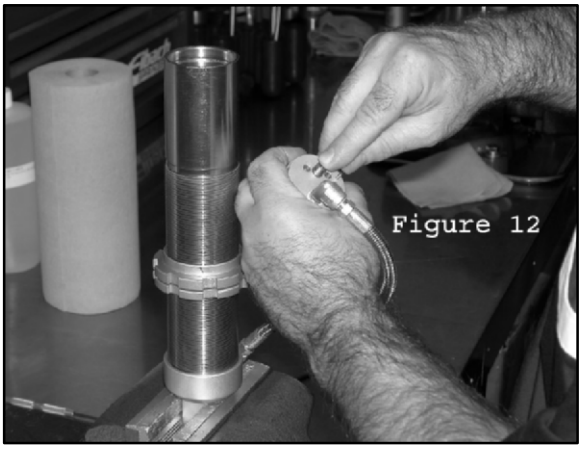


Figure 12

31. Remove the adjuster drum sealing o-ring using a scribe or dental pick. Use extreme caution not to scratch o-ring groove. Clean the adjuster drum with cleaning solvent.
32. Remove the paper towels from the body tube and reservoir. Clean the body tube, reservoir tube, IFP, and CD housing thoroughly with solvent. Dry with compressed air in a well ventilated area. If compressed air is not available, dry parts using clean, lint free paper towels and let sit in a well ventilated area to allow the solvents to evaporate.
33. Lubricate the new adjuster drum o-ring with assembly lube and carefully install it onto the drum. Check to make sure the o-ring is not twisted and is installed correctly.
34. Insert the adjuster drum into CD housing using even pressure to avoid damaging the o-ring. When the adjuster drum is seated properly, the adjuster drum should be flush with the inside surface of the CD housing. (Fig. 13) Check to make sure the drum rotates freely in the bore, and orient the largest cavity of the adjuster drum with the bleed hole (large hole) in the CD housing.

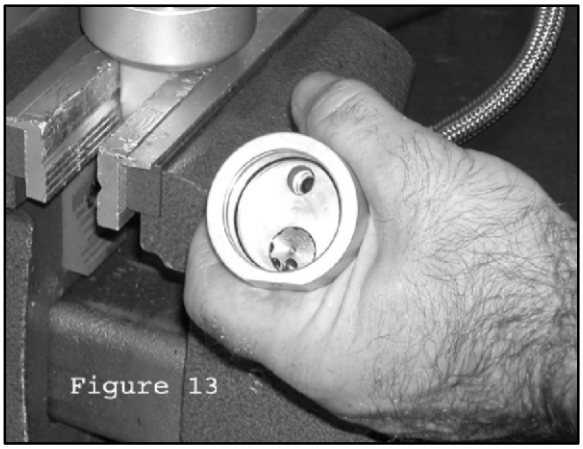


Figure 13

35. Lubricate and carefully install the damp plate sealing o-ring inside the CD housing. Make sure o-ring is properly seated.
36. Insert the damp plate assembly into CD housing with the 5/32" hex head facing out. Align the slot at top of damp plate with the bleed hole in the CD housing. (Fig. 14) Seat the damp plate into CD housing, using even pressure in order to not damage the o-ring. Continue applying pressure to damp plate until it bottoms in CD housing. Insert the wire-retaining ring. The end of the retaining ring should be aligned with the access hole in the side of CD housing for ease of future service on the shock. Check to make sure the retaining ring is properly seated in groove. You may need to use a 5/32" hex key to twist the damp plate assembly clockwise slightly to get the wire ring to seat fully.

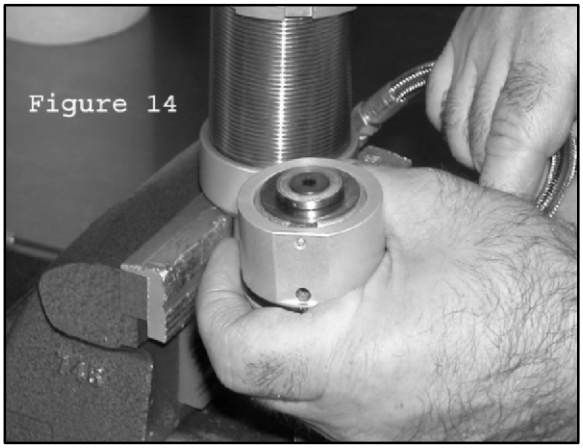


Figure 14

FOX™ REAR SHOCK SERVICE

37. Fill the two holes that are on either side of the adjuster-drum stub with assembly grease. Insert one new spring into each hole. Place one new clicker ball in the center of each spring. Orient the #1 position of knob with the position indicator of the CD housing. (Fig. 15) Install the compression adjustment knob onto adjuster-drum stub. Apply even pressure on knob and press down completely. The clicker balls should recess down into the holes. If they do not, slowly remove the knob, re-seat the clicker balls and try again. Once knob is in position, insert a 5/32" Hex Key into the bleed hole of the CD housing. Secure knob with flat head screw using a 3/32" Hex Key. Install dust shield o-ring by stretching it over the top of the compression adjuster knob.

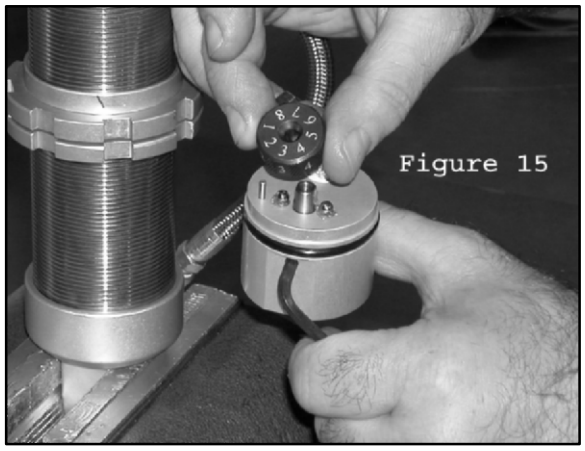


Figure 15

38. Remove the CD housing outer o-ring. Use extreme caution to avoid scratching the o-ring groove. Lubricate the new o-ring with assembly lube, and install it onto the housing.
39. Check the bore of reservoir for any visible signs of wear or damage. Insert the CD housing into the end of the reservoir with the large chamfer on outside edge (Some reservoirs will not have this chamfer. Orientation is not critical on these reservoirs). (Fig. 16) Push the CD housing far enough into the reservoir to expose the CD housing retaining ring groove. Insert the retaining ring into groove. Check to make sure ring is properly seated. Pull CD housing out of reservoir until it engages securely with retaining ring.

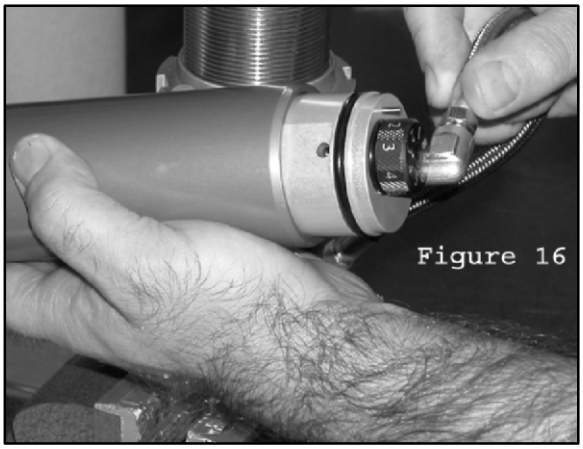


Figure 16

40. Set body assembly aside on a clean, lint free paper towel.
41. Clamp the shaft eyelet securely in vise with the piston end up.
42. Using a 1/4" Flat Blade Screwdriver (newer jets use a 5/32" internal hex),
remove rebound jet from end of shaft by rotating it in a counter-clockwise direction. (Fig. 17)

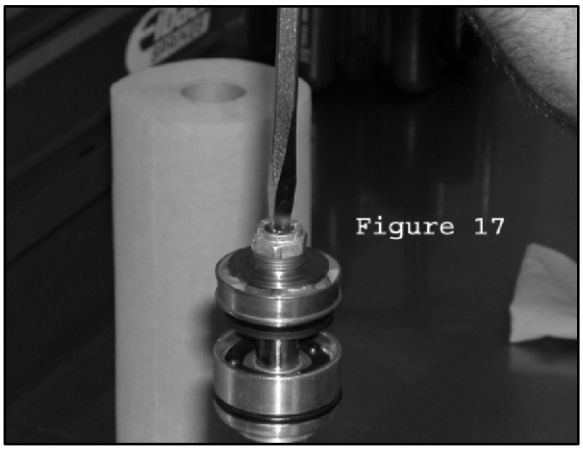


Figure 17

43. Using a 3/4" wrench, remove piston lock nut from end of shaft.

FOX™ REAR SHOCK SERVICE

44. Slide only the tip of Phillips Head Screwdriver into hole at end of shaft. Hold the piston assembly under the top-out plate and lift upwards. Slide the piston assembly onto the shaft of the screwdriver. Remove the screwdriver from shock shaft while supporting the piston assembly. (Fig. 18) Slide a 12-inch tie wrap through the entire piston assembly. Secure the two ends of the zip tie together and remove the screwdriver. There are many pieces to the piston assembly, and the assembly order of these pieces is critical to the proper performance of your shock. This step ensures that the proper order is kept. Place piston assembly on a clean, lint free paper towel.

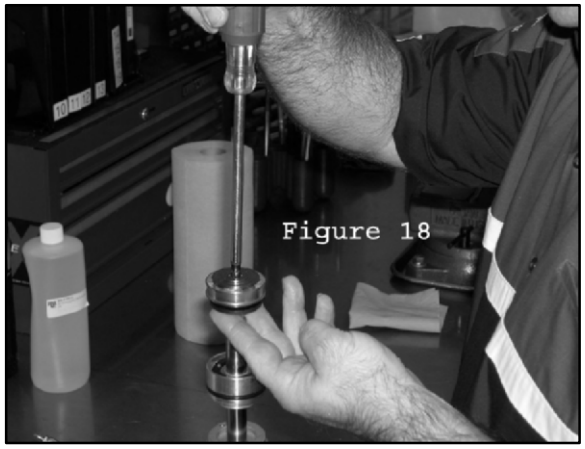


Figure 18

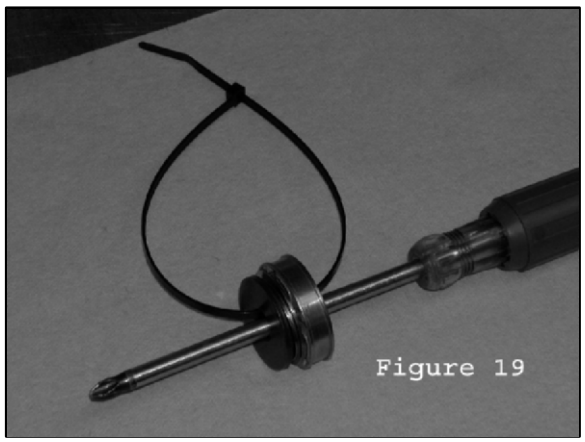


Figure 19

45. Slide bearing assembly off of shaft. Use extreme caution not to scratch inside of the bearing assembly when passing it over the threads at end of shaft. (Fig. 20)

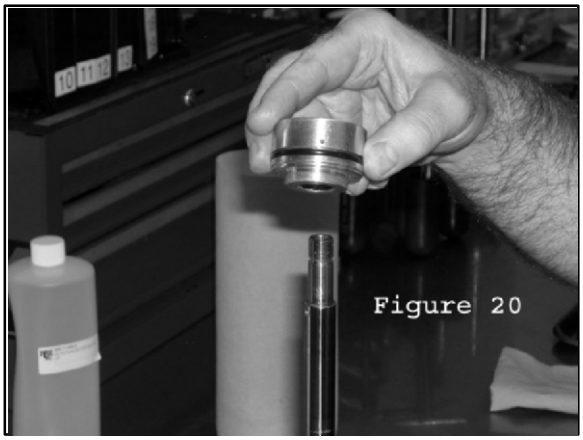


Figure 20

46. Slide the bearing cap and bottom out bumper off of the shaft.
47. Using proper shaft clamps, mount shaft securely in vise. (Fig. 21) NOTE: A very high level of clamping force is required to prevent shaft from spinning in the clamps. Allowing the shaft to spin can cause permanent damage to the shaft and may cause the shock to leak.

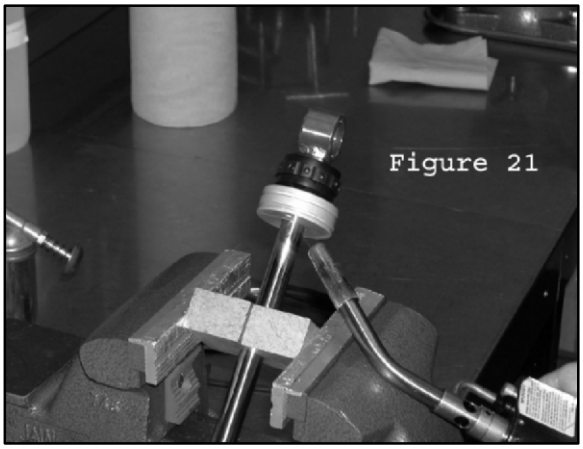


Figure 21

48. Heat eyelet flange with a torch to loosen the thread-locking compound that secures the eyelet to the shaft. (Fig. 21) Extreme caution is to be used when operating a torch. Refer to the torch manufacturers owner's manual for proper operation instructions. Follow all safety guidelines.
49. Use an adjustable wrench to loosen the eyelet from shaft. (Fig. 22) If shaft begins to spin, increase clamping force of vice and repeat previous step. DO NOT remove eyelet completely. Once eyelet is loose, allow it to cool before further handling.

FOX™ REAR SHOCK SERVICE

50. Once the eyelet has been given sufficient time to cool, use an adjustable wrench to remove it from the shaft. Clean the thread-locking compound from eyelet and shaft threads, and set it aside.

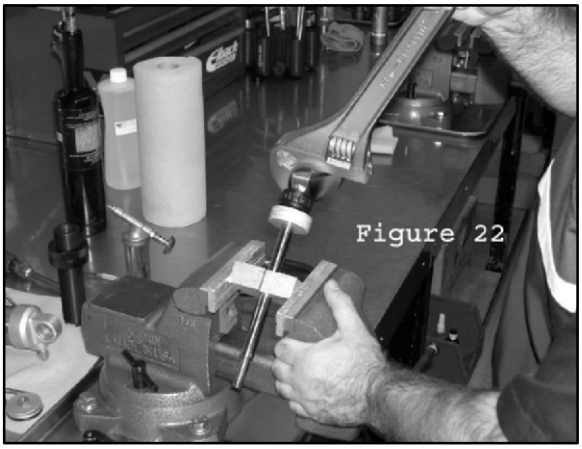


Figure 22

51. Using a scribe or dental pick, push the exposed end of the rebound metering rod into the shock shaft, until it comes out of the piston assembly end. Wipe off any residual oil that coats the rebound-metering rod and set it aside on a clean, lint free paper towel. NOTE: Be very careful to avoid damaging the needle that is attached to the end of the metering rod.
52. Use snap ring pliers to remove the retaining ring from the shaft end. (Fig. 23) Use a scribe or dental pick to remove the brass support washer and metering rod o-ring from end of shaft. (Fig. 24) Use extreme caution not to scratch o-ring gland. Clean all thread locking compound from the end of the shaft.

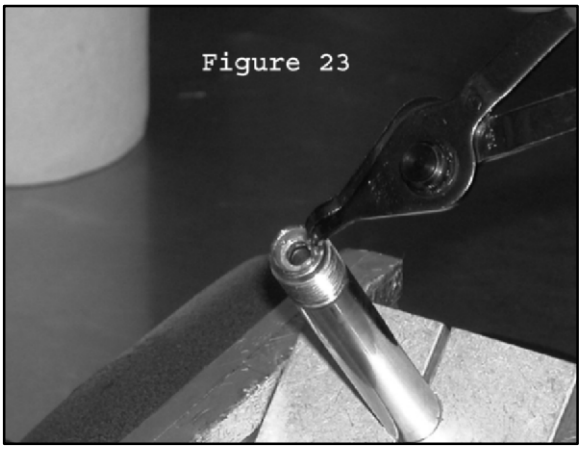


Figure 23

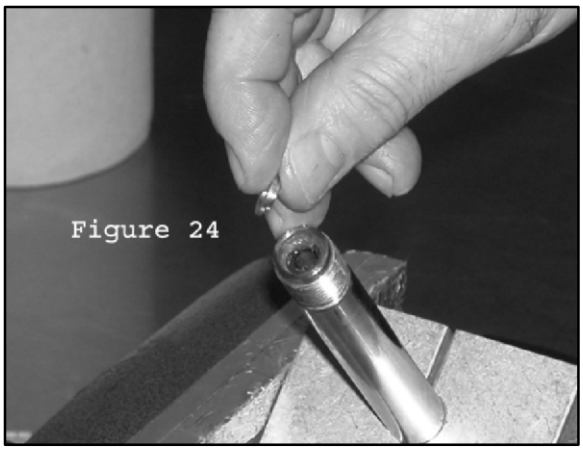


Figure 24

53. Lubricate the new metering rod o-ring and o-ring gland with assembly lube. Install the o-ring, making sure the o-ring is properly seated in the gland. Install brass support washer, with the stepped side against o-ring. Install the new snap ring. Make sure the rounded side of the snap ring faces the brass support washer. Check to make sure snap ring is properly seated.
54. Apply small amount of thread locking compound (Loctite #271 - **PN 2871954**) to shaft threads, and screw the eyelet assembly onto the shaft end. Torque eyelet to 35ft.lbs. (47 Nm).
55. Remove the shaft from clamps.
56. Using a small pair of needle nose pliers, grab the lip of the bearing cap dust seal. Use an inward prying motion to remove the seal. (Fig. 25)

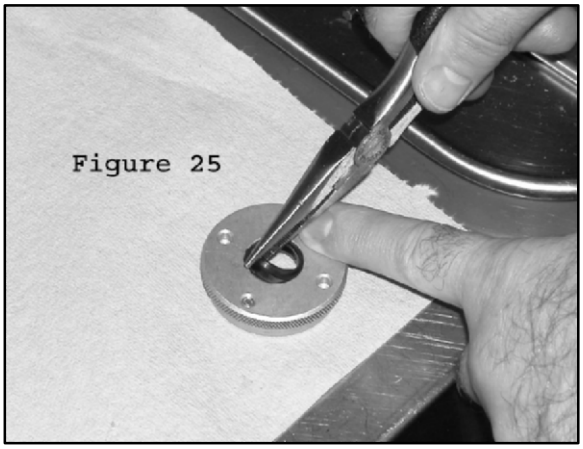


Figure 25

FOX™ REAR SHOCK SERVICE

57. Using a small pair of needle nose pliers, grab the lip of the U-cup seal in the bearing assembly. Use an inward prying motion to remove the seal. (Fig. 26) Use a scribe or a dental pick to remove the o-ring seal from center of the bearing assembly. (Fig. 27) **NOTE:** Use extreme caution when removing seals from bearing assembly. Do not scratch the o-ring groove, or DU bushing. Doing so will compromise the performance of the shock.

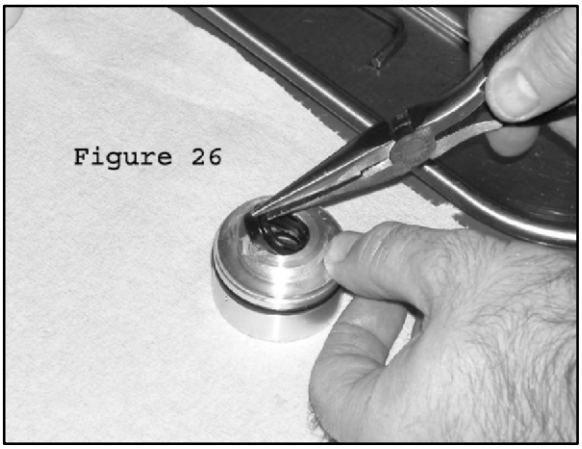


Figure 26

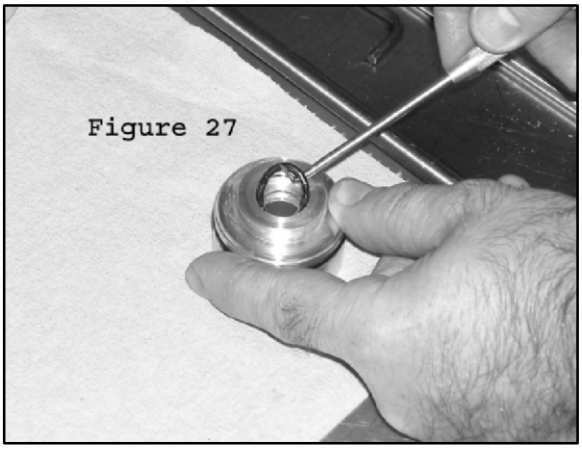


Figure 27

58. Thoroughly clean the bearing, bearing cap, and piston assembly with solvent. Dry with compressed air in a well ventilated area. If compressed air is not available, dry parts using clean, lint free paper towels and let sit in a well ventilated area to allow the remaining solvent to evaporate.

59. Install new dust seal into bearing cap. Seal should be installed with lip protruding from the flat side of the bearing cap. Check to make sure seal is properly seated. If a tool is required to aid in proper seating of seal, use the non-writing end of a pen, or a similar soft, blunt object, to push it in. (Fig. 28)

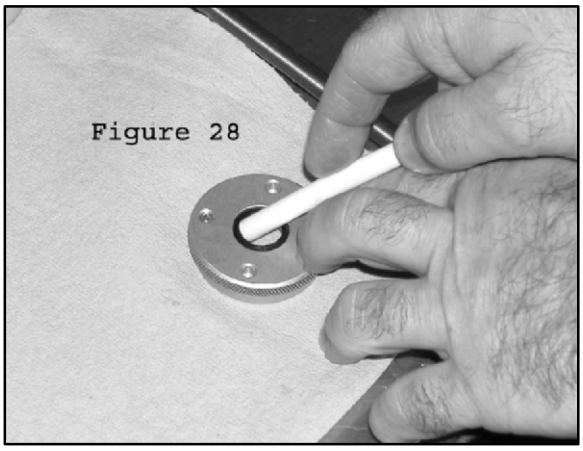


Figure 28

60. Install the new, well lubricated, o-ring into the bearing housing. Correct o-ring placement is in the groove next to the DU bushing. Check to make sure the seal is properly seated, and is not twisted. If a tool is required to aid in proper seating of o-ring, use the non-writing end of a pen, or a similar soft, blunt object, to push it in.
61. Install the new U-cup seal into bearing. U-cup should be installed so the cupped end is facing the DU bushing inside of bearing. Check to make sure seal is properly seated. If a tool is required to aid in proper seating of U-cup seal, use the non-writing end of a pen, or a similar soft, blunt object, to push it in. (Fig. 29)

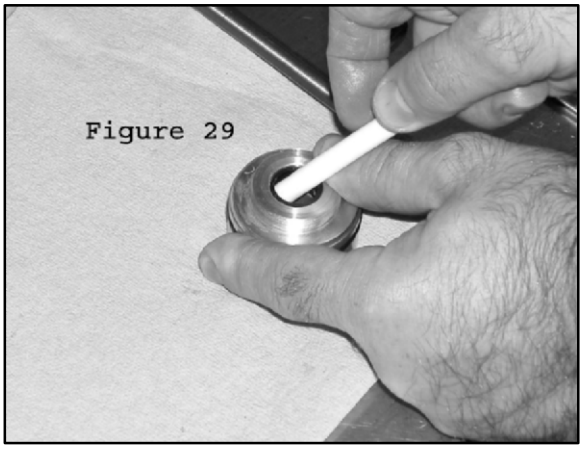


Figure 29

FOX™ REAR SHOCK SERVICE

62. Clamp shaft eyelet securely in vise, and place seal bullet tool on end of shaft.
63. Slide bottom-out bumper onto shaft. **NOTE:** The tapered side of the bottom-out bumper should be facing away from the shaft eyelet.
64. Lubricate the seal bullet tool with assembly lube. Slide the bearing cap onto shaft with the threaded side facing away from the shaft eyelet. (Fig. 30) This should be done in a single smooth motion to avoid damaging the seal. If seal hangs up on the edge of the shaft, DO NOT FORCE IT ON. Remove the bullet tool, with the bearing cap still attached, from the shaft end. (Fig. 32) Remove the bearing cap from the bullet tool, and repeat this step.

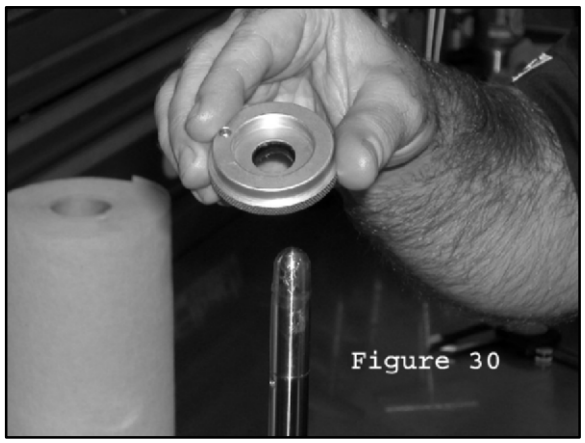


Figure 30

65. Lubricate the bearing assembly seals with an ample amount of assembly lube. Slide the bearing assembly onto shaft with the threaded side facing the bearing cap. (Fig. 31) This should be done in a single smooth motion to avoid damaging the seals. If a seal hangs up on the edge of the shaft, DO NOT FORCE IT ON. Remove the bullet tool, with the bearing assembly still attached, from the shaft end. (Fig. 32) Remove the bearing assembly from the bullet tool, and repeat this step.


Figure 31


Figure 32

66. Insert the shaft of a Phillips head screwdriver through the center of the piston assembly. The pointed end of the screwdriver should be on the same side as the top-out plate (large, black plate). Cut and remove the tie wrap that was holding the piston assembly together.
67. Hold the piston assembly from underneath the top-out plate and insert the end of the screwdriver into the shock shaft. (Fig. 33) Slide the piston assembly onto the shaft end. Verify the piston assembly is seated properly, and install the piston lock nut. Torque the nut to 25ft.lbs. (34 Nm) (Fig. 34).


Figure 33

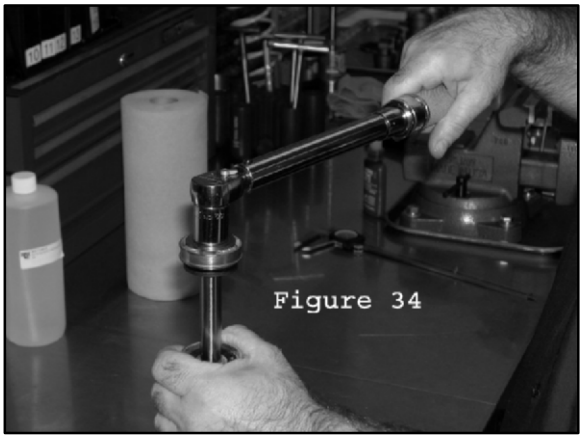


Figure 34

FOX™ REAR SHOCK SERVICE

68. Lubricate the flat end of the metering rod with a small amount of assembly lube. Insert metering rod, flat end first, into the shaft. (Fig. 35) Push needle down into the shaft with a blunt object, until you feel the metering rod push past the o-ring seal. Install the shaft jet using a torque driver. Torque jet to **40 in.lbs. (4.5 Nm)**. Remove shaft assembly from vice and set it aside on a clean, lint free paper towel.

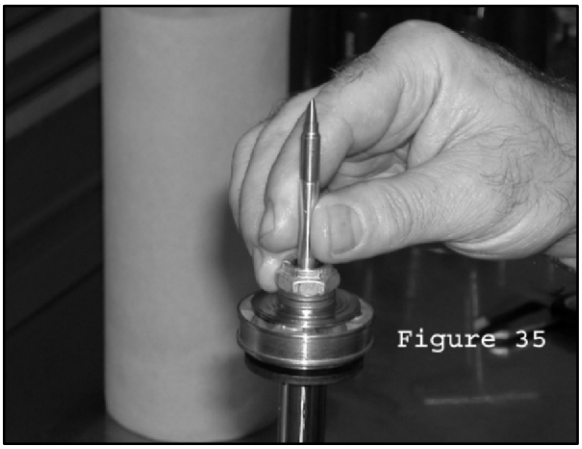


Figure 35

69. Clamp the body cap of the shock securely in the vice, with the open end of the body facing up. Set compression adjustment knob to position #8.
70. Lubricate the new IFP o-ring with an ample amount of assembly lube, and install it onto the IFP.
71. Hold the reservoir tube at a level that is below the shock body tube with the open-end facing up. Fill the reservoir to retaining ring groove with Fox 5wt. shock oil. You should see bubbles rising to oil surface. Wait until bubbling slows or stops completely. If oil level has fallen, add more oil until level is at retaining ring groove. Insert IFP into reservoir. Use a smooth motion and push straight in until o-ring seats into the retaining ring groove, allowing oil to overflow. Set the compression adjustment knob to the #1 position. Use your free hand to wrap new piston band around IFP with the rounded edge out, and push the IFP into the reservoir until the edge is flush with the end of the reservoir. (Fig. 36) Be careful not to pinch the piston band. Set the compression adjustment knob to position #1. Now, holding the reservoir below the body tube with the compression adjuster side up, push IFP into reservoir tube until it bottoms out inside. (Fig. 37) You should see large air bubbles rise to the surface of the oil in the body tube.


Figure 36


Figure 37

72. Fill shock body half way with oil. While still holding the reservoir below the body tube, very slowly pull back on the IFP. (Fig. 38) Be careful not to pull the IFP out completely. Wait one minute then push the IFP back to the bottom. You should see bubbles rising to the surface inside the body tube. Repeat this process several times until you don't see any new bubbles inside the body tube.

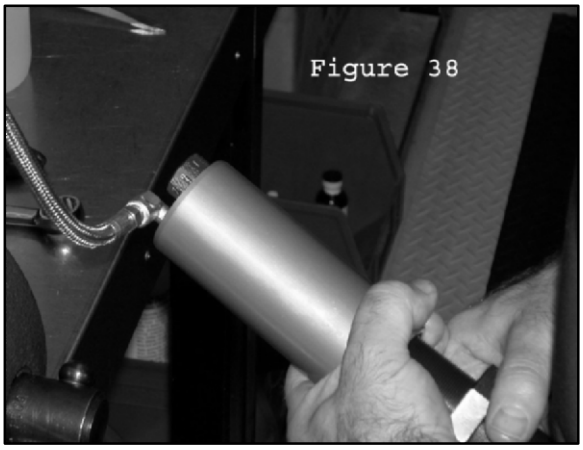


Figure 38

FOX™ REAR SHOCK SERVICE

73. Set compression adjuster to the #3 position. Firmly grip the reservoir hose at the CD housing. With your other hand pull back forcefully on the IFP Depth Setting Tool (**PN 2871351**), until the edge of the IFP is close to being flush with the edge of the reservoir. Stop the IFP in this position. As you pull forcefully on the IFP, you should feel tension as the IFP pulls back. This step is done to open the damp plate circuit and bleed the system. Let the reservoir hang in this position for a minimum of 5 minutes.
74. Hold the reservoir under the body tube with the compression adjuster facing up. Slowly push the IFP into the reservoir until it bottoms out. Set compression adjuster to the #8 position.
75. Fill the body tube with oil approximately 1/2" below the retaining ring groove. Wrap the new piston band around the piston, making sure the rounded edges face out. Insert the shaft assembly into the body tube, allowing oil to overflow. (Fig. 39) Slowly push shaft into body until the piston assembly is approximately 1" below the oil surface. Slowly pull shaft assembly out of the body until the rebound ports of the shaft are just below the oil surface. If you pull the shaft out too far you will hear a sucking noise that means air was pulled in, and will have to start the bleeding process over. Add oil as necessary. Repeat the previous steps until there are no more bubbles rising to the oil surface.


Figure 39

76. Hold the shaft assembly as straight as possible and hit the shaft eyelet a couple of times, squarely from above, with a rubber mallet. (Fig. 40) This is done to momentarily open the shim stack and allow any trapped air to escape. You should see small bubbles rise to the surface. Fill body tube with oil until oil level is flush with edge of body tube. Slowly pull the shaft out until the rebound ports are just below the oil surface.

If you pull the shaft out too far you will hear a sucking noise, meaning air was pulled in. If this happens, you will have to start the bleeding process over. Add oil as necessary.


Figure 40

77. Hold the shaft eyelet with one hand. With other hand, slide the bearing assembly down the shaft until contact with oil is made. Find the bleed port in bearing assembly, and position it away from your face and body. With one hand, very slowly push the bearing assembly into body tube. Be sure to have a small container in your other hand to catch the excess oil as it flows out of the bleed port in the bearing. Do not allow the shaft to move as you push the bearing in until the bearing makes contact with the piston assembly. Then, push bearing and shaft assembly into body tube until it stops at the external o-ring of the bearing assembly. (Fig. 41) With one hand continue applying pressure to the bearing assembly. With other hand, set the compression adjustment knob to the #1 position. As you do this, the bearing and shaft assembly should push further into the body tube. Push the bearing and shaft assembly into the body tube until the retaining ring groove is exposed. (Fig. 42) Install the wire-retaining ring, and check to make sure retaining ring is properly seated.

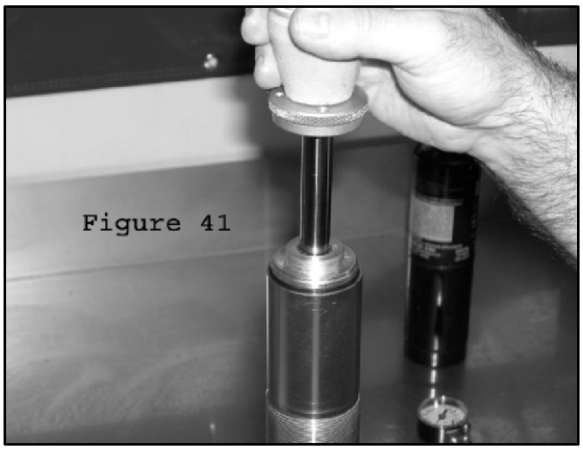
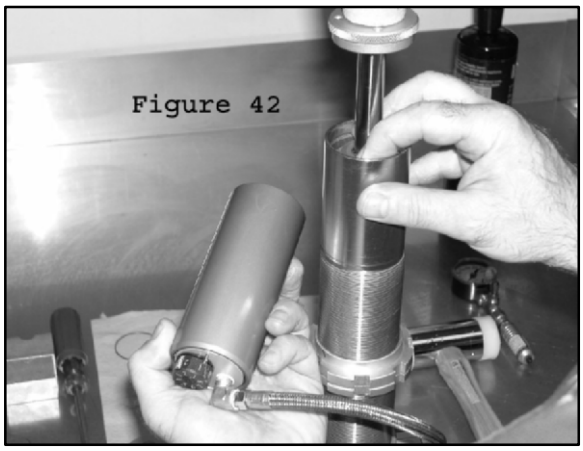
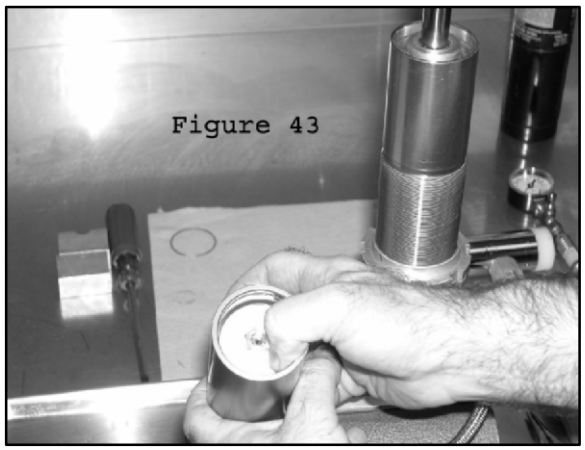
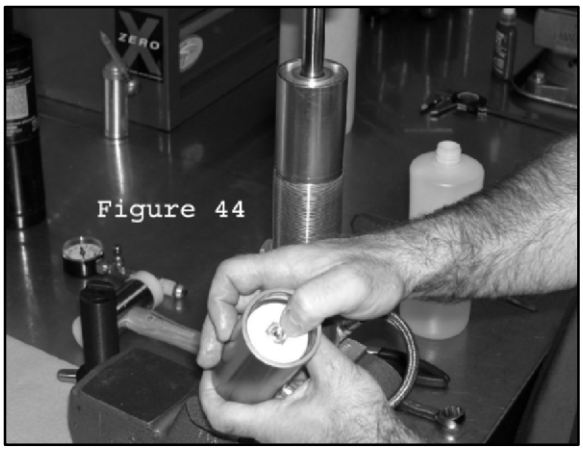


Figure 41

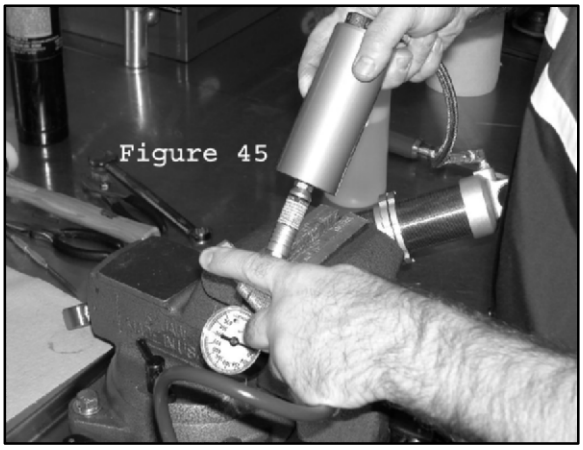


78. Push the IFP further into the reservoir. As you do this, the shaft and bearing assembly should rise until the bearing assembly engages with the wire retaining ring inside the body tube. Remove the IFP depth setting tool by rotating it 90 degrees.
79. Install the reservoir end cap with the air valve facing the outside of the reservoir tube. (Fig. 43) Push down on the reservoir end cap using even pressure, until the retaining ring groove is exposed. (Fig. 44) Install the wire retaining ring, and check to make sure retaining ring is seated properly. Push the shaft assembly completely into the body tube. If reservoir cap is not properly seated against the retaining clip, tap it gently with a rubber mallet until it snaps into place. Remove shock assembly from vise.





80. Securely clamp Fox Nitrogen Safety Needle in the vise. Be sure to point the air valve away from your face and body.
81. Insert the safety needle squarely into center of the air valve and pressurize the reservoir to 300psi. (Fig. 45) Continue charging with gas as you pull the reservoir away from the Fox™ Nitrogen Safety Needle using a smooth, straight motion. Keep the reservoir as straight as possible to prevent the safety needle from bending. As the safety needle is pulled free from the Fox™ air valve, a popping sound should be heard. ***WARNING: CHARGE THE SHOCK USING NITROGEN GAS ONLY. DO NOT FILL WITH ANY OTHER GASSES. Doing so will compromise the performance of the shock and is EXTREMELY DANGEROUS!***



82. Install the button-head screw into the Fox™ air valve, using a 3/32" Hex Key.
83. Remove the shock from the vise.
84. Clean all oil residue from the shock and reservoir with solvent, and dry with compressed air in a well-ventilated area. If compressed air is not available, dry the shock and reservoir using clean, lint free paper towels and let sit in a

well-ventilated area to allow the solvents to evaporate.

85. Clamp the body cap of shock securely in vice, with shaft end up. Use pin spanner tool to secure the bearing cap to bearing. Using a 3/32" hex key, tighten the setscrew to lock the bearing cap into place.
86. Compress shock completely. (Fig. 46) Roughly 90 pounds of force is required to initiate movement of shaft. Once shock is fully compressed, turn rebound adjustment knob clockwise until it stops. Let go of the shaft. The shaft should extend very slowly (or not at all). Turn rebound adjustment knob counter clockwise and set to the position recorded previously. The shaft should speed up as adjuster is opened.

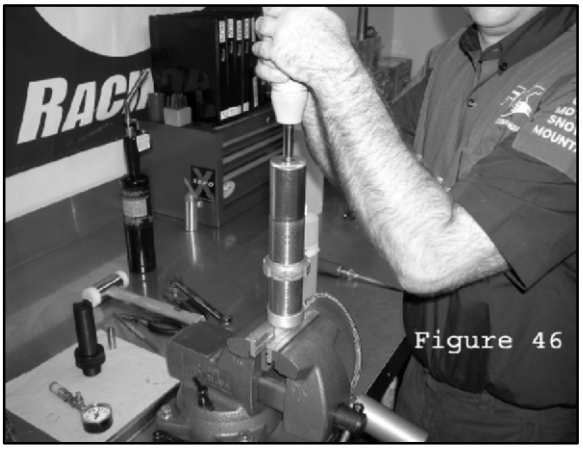
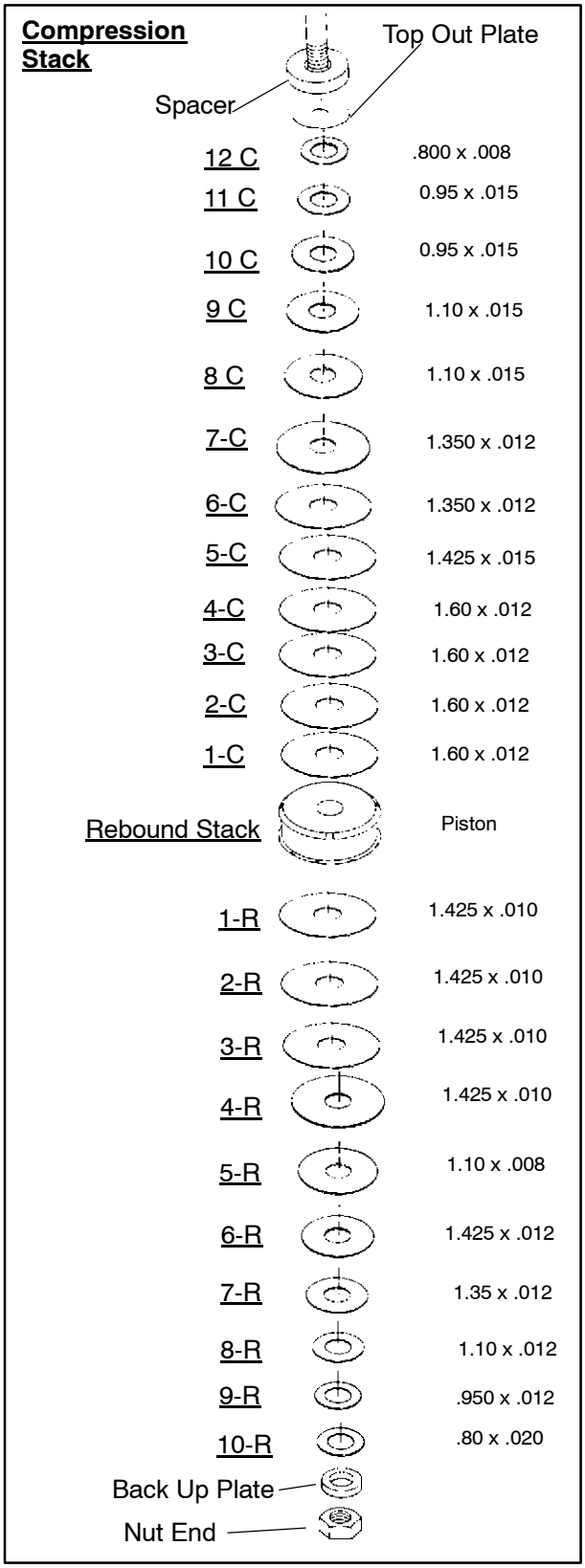


Figure 46

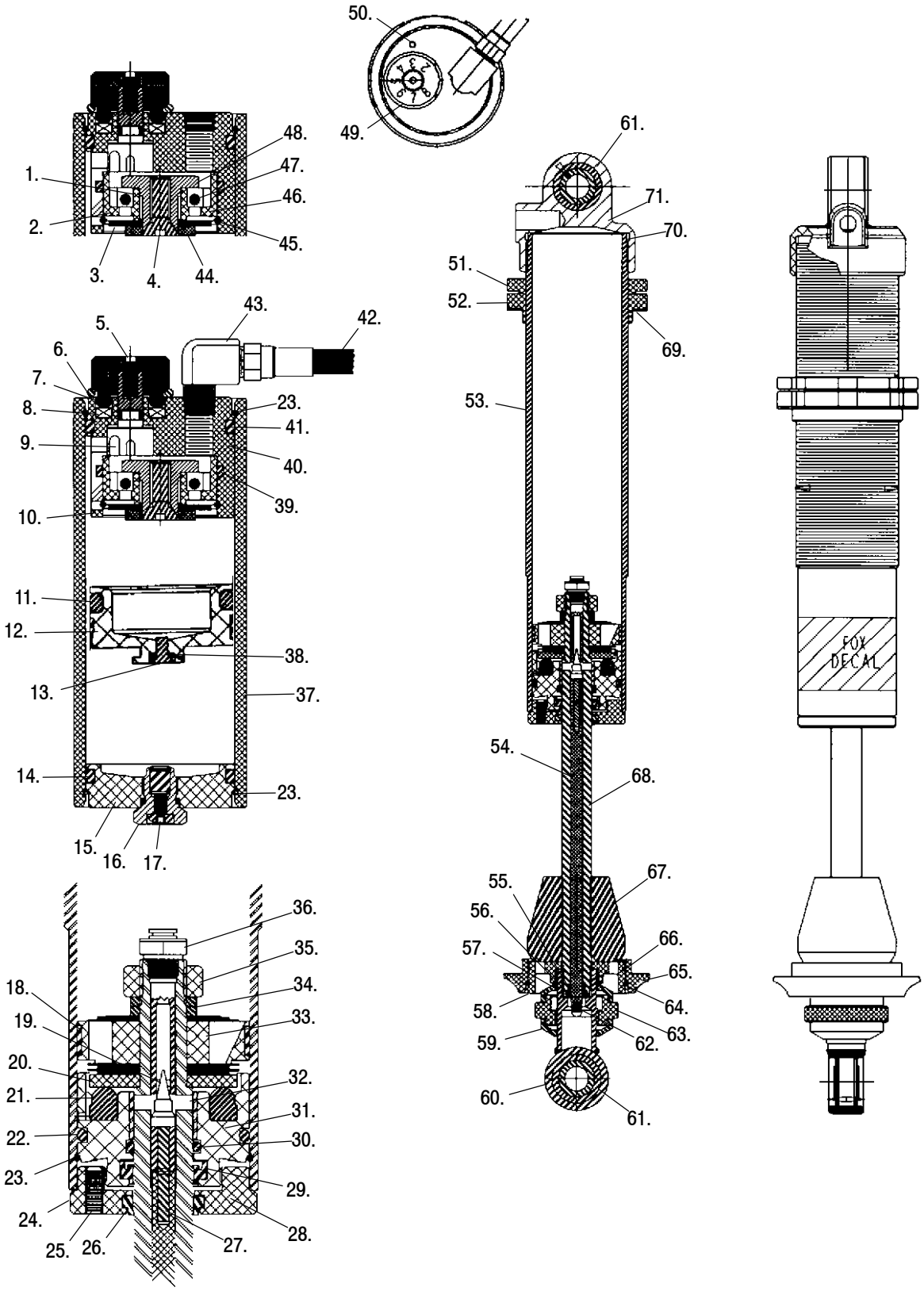
87. Reinstall the stainless steel spring support washer, the spring, and the spring retainer. Place the wire retaining ring into the groove on the spring retainer adapter, and seat the spring retainer against it.
88. Thread the spring preload ring down against the spring, and set the preload to the measurement you took when you removed the spring. (Fig. 1) Thread the preload lock ring down against the preload ring, and tighten them together to lock them in place.
89. Set the compression adjustment knob to the position recorded previously.
90. Remove the shock from the vise.
91. Reinstall spherical bearing o-rings and reducers.

NOTICE: After installation, be sure to RIDE SLOWLY in the beginning to ensure the shock and the vehicle's suspension is performing correctly.

FOX™ SHOCK STANDARD VALVING CHART



FOX™ REAR SHOCK EXPLODED VIEW



FOX™ REAR SHOCK EXPLODED VIEW, CONT'D

Ref.	Qty	Description
	1	Shock, Remote Reservoir, Rear
1.	1	Valve
2.	1	Plate, Damp
3.	5	Valve
4.	1	Screw
5.	1	Screw
6.	1	O-Ring
7.	2	Ball
8.	2	Spring
9.	1	Drum, Damping
10.	1	Housing, CD
11.	1	O-Ring
12.	1	Piston, Floating
13.	1	Screw
14.	1	O-Ring
15.	1	Asm., Reservoir End Cap
16.	1	Valve, Air
17.	1	Screw
18.	2	Bearing
19.	1	Needle, Damping Adjust
20.	1	Plate, Top/Out
21.	1	Bumper, Top/Out
22.	1	O-Ring
23.	3	Ring, Retaining
24.	1	Cap, Bearing
25.	1	Screw
26.	1	Wiper
27.	1	Pin, Spring
28.	1	Bearing
29.	1	U-Cup
30.	1	O-Ring
31.	1	Bearing
32.	1	Bearing, Internal
33.	1	Piston, Damping
34.	2	Plate, Back-Up
35.	1	Nut, Lock
36.	1	Jet
37.	1	Reservoir
38.	1	O-Ring
39.	1	O-Ring
40.	1	Housing, Damping
41.	1	O-Ring
42.	1	Hose
43.	2	Fitting, Elbow, 90 Degree
44.	1	Washer
45.	1	Ring, Retaining
46.	1	Asm., Damping Adjust
47.	2	Ball
48.	1	Bolt
49.	1	Knob, Damping
50.	1	Pin, Dowel
51.	1	Ring, Preload
52.	1	Ring, Preload
53.	1	Body
54.	1	Rod, Metering
55.	1	O-Ring
56.	1	Washer, Brass
57.	1	Ring, Snap
58.	1	Spring, Retainer Adapter
59.	2	Cover, Dust
60.	1 1	Adjust, RD (Incl. 59.,66.,64.,62.,58.,63.) Extension, Eyelet
61.	2 1	Bearing, Spherical Ring, Snap
62.	1	Pin, Dowel
63.	1	Knob, 12 Click
64.	1	Wire, Retaining Ring
65.	1	Retainer, Spring
66.	1	O-Ring
67.	1	Bumper, Bottom/Out
68.	1	Shaft
69.	1	Washer, Thrust
70.	1	O-Ring
71.	1	Asm., Body Cap

CHAPTER 6
BRAKES

SPECIFICATIONS

Front Brake Caliper		
Item	**Standard**	**Service Limit**
Brake Pad Thickness	.298″ / 7.6mm	.180″ / 4.6mm
Brake Disc Thickness	.150-.165″ / 3.810-4.166mm	.140″ / 3.556mm
Brake Disc Thickness Variance Between Measurements	-	.002″ / .051mm
Brake Disc Runout	-	.010″ / .50mm

Rear Brake Caliper		
Item	**Standard**	**Service Limit**
Brake Pad Thickness	.298″ / 7.6mm	.180″ / 4.6mm
Brake Disc Thickness	.177-.187″ / 4.496-4.750mm	.167″ / 4.242mm
Brake Disc Thickness Variance Between Measurements	-	.002″ / .051mm
Brake Disc Runout	-	.010″ / .25mm

Master Cylinder I.D.	.750″
Master Cylinder I.D. - Aux. Rear	.500″

TORQUE SPECIFICATIONS

Item	Torque (ft. lbs. except where noted*)	Torque (Nm)
Front Caliper Mounting Bolts	18.0	25
Rear Caliper Mounting Bolts	15.0	21
Master Cylinder Mounting Bolts	25 in. lbs.	3.0
Master Cylinder Reservoir Cover Bolts – Front	45 in. lbs.	5.0
Brake Line Banjo Bolt	15.0	21
Front Brake Disc	18.0	25
Front Wheel Mounting Nuts	20.0	28
Front Master Cylinder Clamp Bolts	25 in. lbs.	3.0
Caliper Bleed Screws	27 in. lbs.	3.1

NOTE: Refer to the tightening procedures in this chapter when torquing the bolts. Some special procedures are used when torquing certain bolts and fasteners.

SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
2870975	Mity Vac™

BRAKE SYSTEM SERVICE NOTES

Disc brake systems are light weight, low maintenance, and perform well in the conditions ATVs routinely encounter. There are a few things to remember when replacing disc brake pads or performing brake system service to ensure proper system function and maximum pad service life.

- Optional pads are available to suit conditions in your area. Select a pad to fit riding style and environment.
- Do not over-fill the master cylinder fluid reservoirs.
- Make sure the brake levers return freely and completely.
- Check and adjust master cylinder reservoir fluid levels after pad service.
- Make sure atmospheric vent on reservoirs are unobstructed.
- Test for brake drag after any brake system service and investigate cause if brake drag is evident.
- Make sure caliper moves freely on guide pins.
- Inspect caliper piston seals for foreign material that could prevent caliper pistons from returning freely.
- Perform a brake burnishing procedure after installing new pads to maximize service life.

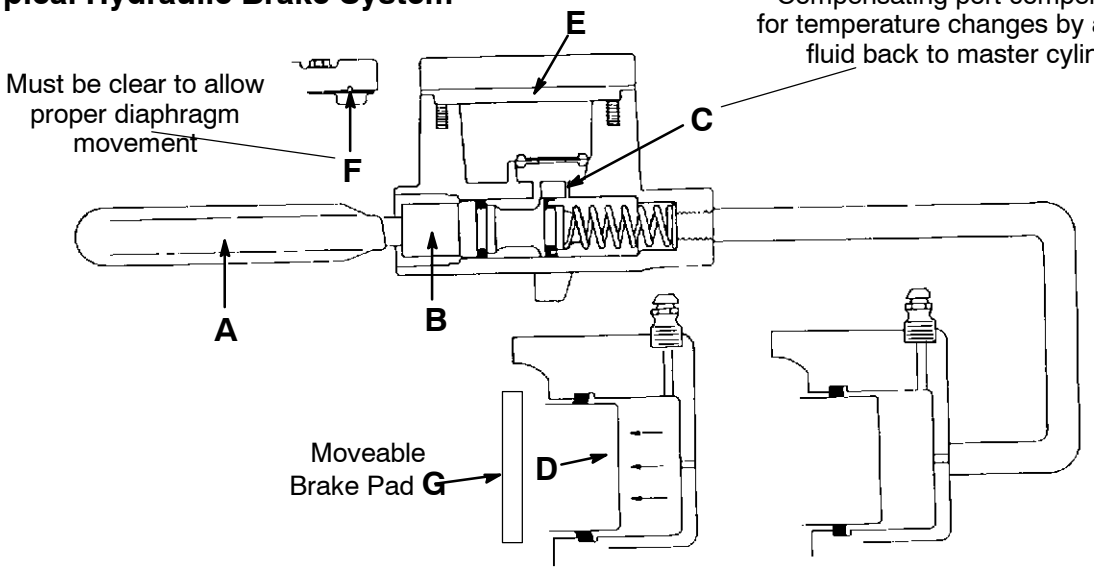
BRAKE NOISE TROUBLESHOOTING

Dirt or dust buildup on the brake pads and disc is the most common cause of brake noise (squeal caused by vibration). If cleaning does not reduce the occurrence of brake noise, check the backing of each pad for worn spots allowing metal to metal contact. See table below.

Brake Noise Troubleshooting	
Possible Cause	**Remedy**
Dirt, dust, or imbedded material on pads or disc	Spray disc and pads with a non-flammable aerosol brake cleaner. Remove pads and/or disc hub to clean imbedded material from disc or pads.
Pad(s) dragging on disc (noise or premature pad wear) Improper adjustment Insufficient lever or pedal clearance Master cylinder reservoir overfilled Master cylinder compensating port restricted Master cylinder piston not returning completely Caliper piston(s) not returning Operator error (riding the brake / park brake applied)	 Adjust pad stop (front calipers) Check position of controls & switches. Set to proper level Clean compensating port Inspect. Repair as necessary Clean piston(s) seal Educate operator
Loose wheel hub or bearings	Check wheel and hub for abnormal movement.
Brake disc warped or excessively worn	Replace disc
Brake disc misaligned or loose	Inspect and repair as necessary
Noise is from other source (chain, axle, hub, disc or wheel)	If noise does not change when brake is applied check other sources. Inspect and repair as necessary
Wrong pad for conditions	Change to a softer or harder pad

HYDRAULIC BRAKE SYSTEM OPERATION

Typical Hydraulic Brake System



The Polaris brake system consists of the following components or assemblies: brake lever; master cylinder; hydraulic hose; brake calipers (slave cylinder); brake pads; and brake discs, which are secured to the drive line.

When the hand activated brake lever (A) is applied it contacts a piston (B) within the master cylinder. As the master cylinder piston moves inward it closes a small opening (compensating port) (C) within the cylinder and starts to build pressure within the brake system. As the pressure within the system is increased, the piston (D) located in the brake caliper moves outward and applies pressure to the moveable brake pad. This pad contacts the brake disc and moves the caliper in its floating bracket, pulling the stationary side pad into the brake disc. The resulting friction reduces brake disc and vehicle speed. As the lever pressure is increased, the braking affect is also increased.

The friction applied to the brake pads will cause the pads to wear. As these pads wear, the piston within the caliper moves further outward and becomes self adjusting. Fluid from the reservoir fills the additional area created when the caliper piston moves outward.

Brake fluid level is critical to proper system operation. Too little fluid will allow air to enter the system and cause the brakes to feel spongy. Too much fluid could cause brakes to drag due to fluid expansion.

Located within the master cylinder is the compensating port (C) which is opened and closed by the master cylinder piston assembly. The port is open when the lever is released and the master cylinder piston is outward. As the temperature within the hydraulic system changes, this port compensates for fluid expansion (heated fluid) or contraction (cooled fluid). During system service, be sure this port is open. Due to the high temperatures created within the system during heavy braking, it is very important that the master cylinder reservoir have adequate space to allow for fluid expansion. **Never overfill the reservoir!** Fill to 1/4″ - 5/16″ (.64 - .80 cm) from top of the cylinder.

This system also incorporates a diaphragm (E) as part of the cover gasket; and a vent port (F) located between the gasket and the cover. The combination diaphragm and vent allow for the air above the fluid to equalize pressure as the fluid expands or contracts. Make sure the vent is open and allowed to function. If the reservoir is over filled or the diaphragm vent is plugged the expanding fluid may build pressure in the brake system leading to brake failure.

When servicing Polaris ATV brake systems use only Polaris DOT 3 High Temperature Brake Fluid (**PN 2870990**). **WARNING:** Once a bottle is opened, use what is necessary and discard the rest in accordance with local laws. Do not store or use a partial bottle of brake fluid. DOT 3 Brake fluid is hygroscopic, meaning it rapidly absorbs moisture. This causes the boiling temperature of the brake fluid to drop, which can lead to brake fade and possible loss of control.

FLUID REPLACEMENT/BLEEDING PROCEDURE

NOTE: When bleeding the brakes or replacing the fluid always start with the caliper farthest from the master cylinder.

CAUTION:

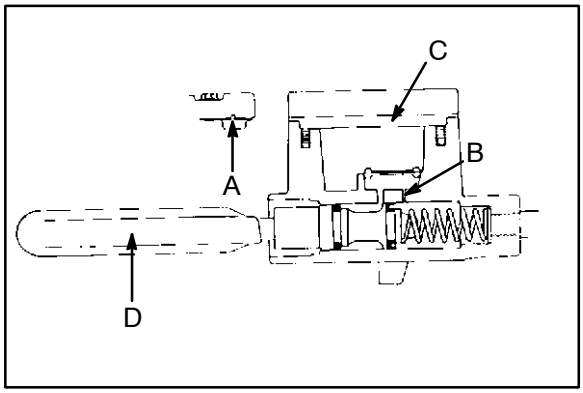
Always wear safety glasses during these procedures.

CAUTION:

Brake fluid will damage finished surfaces. Do not allow brake fluid to come in contact with finished surfaces.

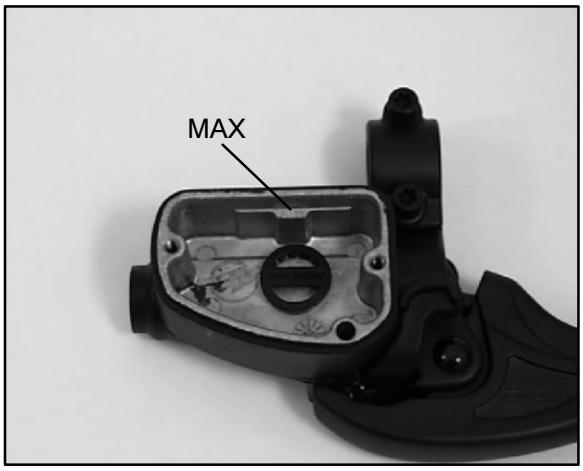
BRAKE BLEEDING - FLUID CHANGE

NOTE: This procedure should be used to change fluid or bleed brakes during regular maintenance.



1. Clean reservoir cover thoroughly.
2. Remove screws, cover, and diaphragm (C) from reservoir.
3. Inspect vent slots (A) in cover and remove any debris or blockage.
4. If changing fluid, remove old fluid from reservoir with a Mity Vac™ (**PN 2870975**) or similar tool.

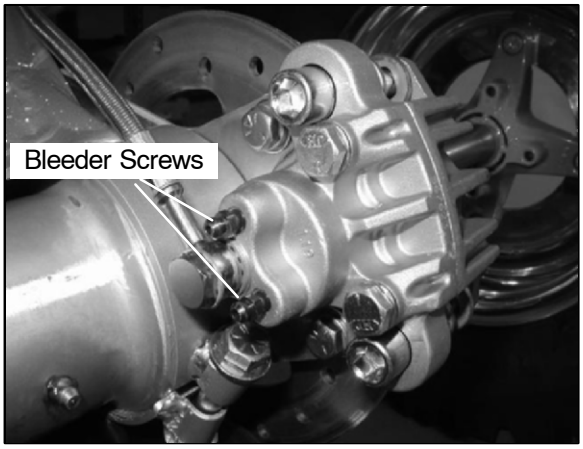
NOTE: Do not remove brake lever when reservoir fluid level is low.



5. Add brake fluid to the upper level mark on reservoir.

Polaris DOT 3 Brake Fluid

(PN 2870990)



6. Begin bleeding procedure with the caliper that is farthest from the master cylinder. Install a box end wrench on the top caliper bleeder screw. Attach a clean, clear hose to fitting and place the other end in a clean container. Be sure the hose fits tightly on fitting.

NOTE: Fluid may be forced from compensation port (B) when brake lever is pumped. Place diaphragm (C) in reservoir to prevent spills. Do not install cover. Refer to Illustration on page 9.4.

7. *Slowly* pump brake lever (D) until pressure builds and holds.
8. While maintaining lever pressure, open bleeder screw. Close bleeder screw and release brake

lever. **NOTE:** Do not release lever before bleeder screw is tight or air may be drawn into caliper.

9. Repeat procedure until clean fluid appears in bleeder hose and all air has been purged. Add fluid as necessary to maintain level in reservoir.

CAUTION:

Maintain at least 1/2″ (1.27 cm) of brake fluid in the reservoir to prevent air from entering the master cylinder.

10. Tighten bleeder screw securely and remove bleeder hose. Torque bleeder screw to 25 in.lbs. (3 Nm).
11. Repeat procedure Steps 5-9 for the remaining caliper(s).

12. Add brake fluid to the proper level.

Master Cylinder Fluid Level:

MAX level inside reservoir

Sight glass must look dark, if sight glass is clear, fluid level is too low

13. Install diaphragm, cover, and screws. Torque the screws to 45 in.lbs. (5 Nm).

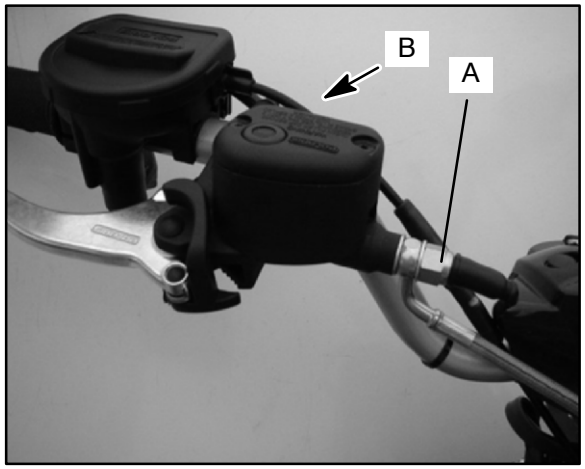
Reservoir Cover Torque -

45 in. lbs. (5 Nm)

14. Field test machine at low speed before putting into service. Check for proper braking action and lever reserve. With lever firmly applied, lever reserve should be no less than 1/2″ (1.3 cm) from handlebar.
15. Check brake system for fluid leaks and inspect all hoses and lines for wear or abrasion. Replace hose if wear or abrasion is found.

MASTER CYLINDER REMOVAL

1. Clean master cylinder and reservoir assembly. Make sure you have a clean work area to disassemble brake components.
2. Place a shop towel under brake line connection at master cylinder. Loosen banjo bolt (A); remove bolt and sealing washers.

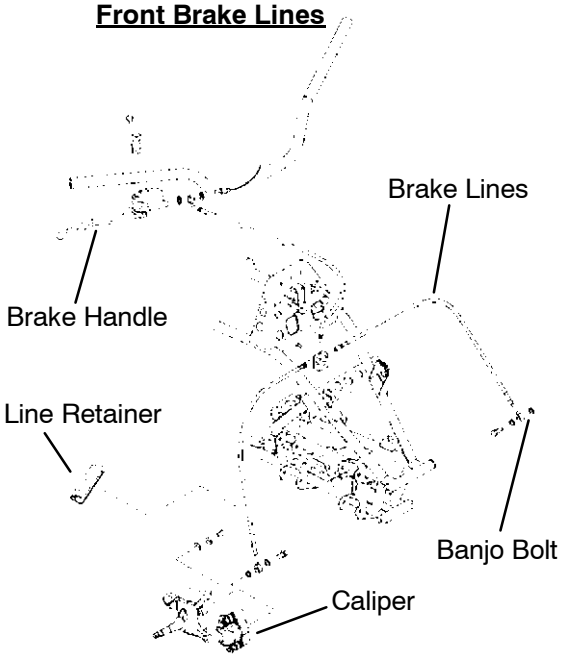


CAUTION:

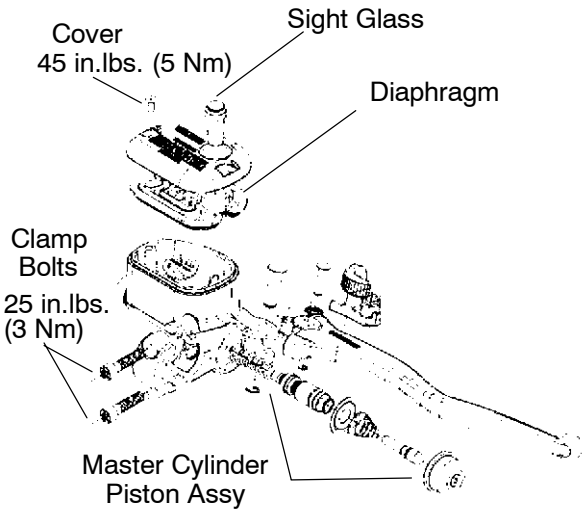
Brake fluid will damage finished surfaces. Do not allow brake fluid to come in contact with finished surfaces.

3. Loosen the master cylinder clamp bolts (B) on the handlebar side of the master cylinder.
4. Remove master cylinder from handlebars.

Front Brake Lines

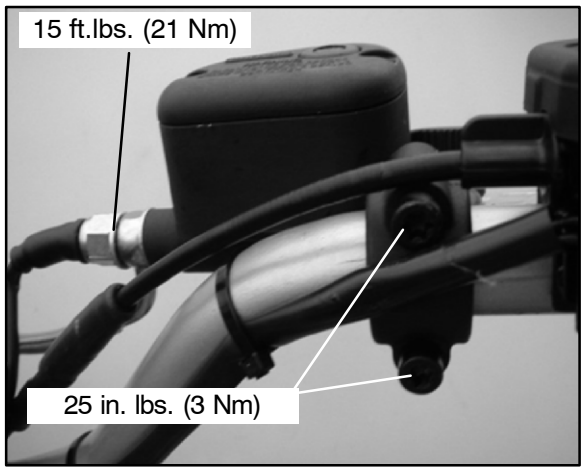


Master Cylinder Assembly



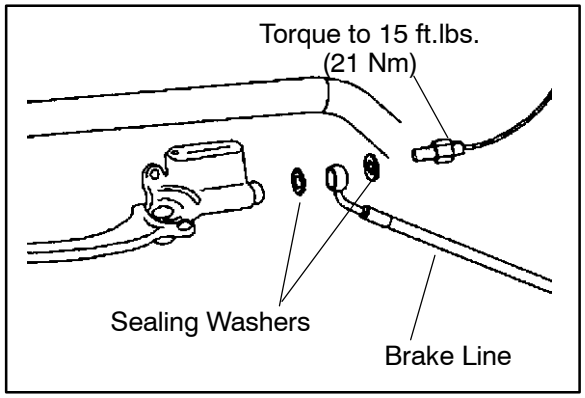
MASTER CYLINDER INSTALLATION

1. Install master cylinder on handlebars. Torque mounting bolts to **25 in. lbs. (3 Nm)**. Torque the top bolt first.



NOTE: To speed up the brake bleeding procedure the master cylinder can be purged of air before brake line is attached. Fill with DOT3 Brake Fluid (**PN 2870990**) and pump lever slowly two to three times with finger over the outlet end to purge master cylinder of air.

2. Place new sealing washers on each side of banjo brake line. Install the brake line into the master cylinder. Torque the brake switch bolt to **15 ft.lbs. (21 Nm)**.



Master Cylinder Mounting Clamp Bolt Torque: 25 in. lbs. (3 Nm)

Brake Switch Bolt Torque: 15 ft. lbs. (21 Nm)

3. Fill reservoir with DOT3 Brake Fluid (**PN 2870990**).

Polaris DOT 3 Brake Fluid

(PN 2870990)

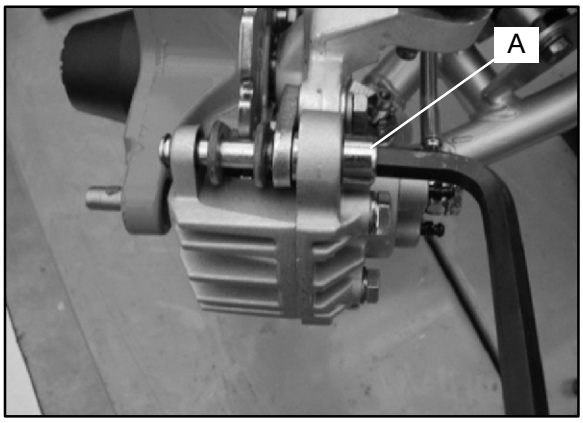
4. Follow bleeding procedure on Pages 9.5-9.6. Check all connections for leaks and repair if necessary.

FRONT PAD REMOVAL

1. Elevate and support front of machine.

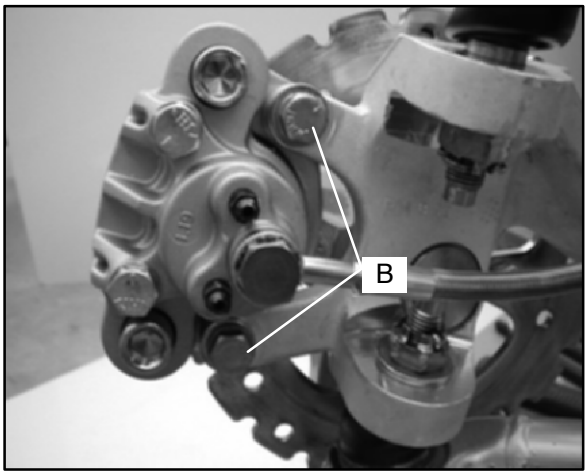
CAUTION:

Use care when supporting vehicle so that it does not tip or fall. Severe injury or damage may occur if machine tips or falls.

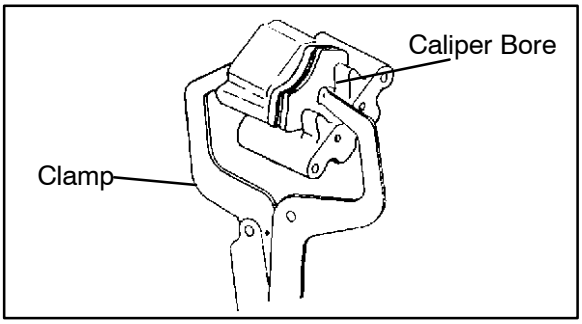


2. Remove the front wheel. With the caliper installed loosen the brake caliper slide bolts (A).

3. Remove the caliper bolts (B) and caliper from the mount bracket.

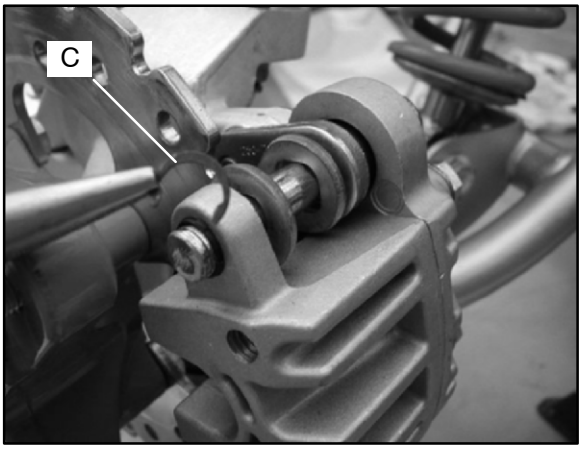


4. With pads installed, push caliper piston into caliper bore slowly using a C-clamp or locking pliers.

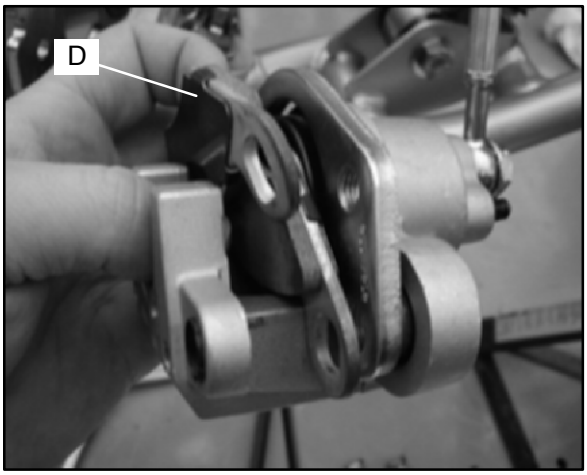


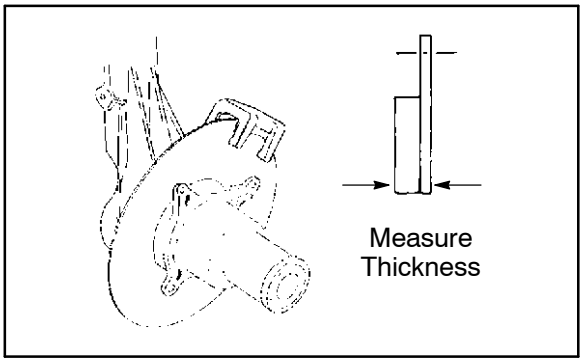
NOTE: Brake fluid will be forced through compensating port into master cylinder fluid reservoir when piston is pushed back into caliper. Remove excess fluid from reservoir as required.

5. Remove the c-clips (C) from the end of the caliper slide bolts.



6. Remove the loose caliper slide bolts. The brake pad (D) will slide out of the caliper assembly when the caliper slide bolt is removed.





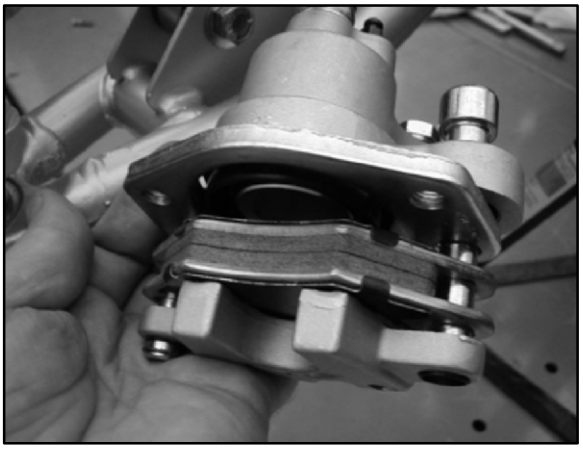
7. Measure the thickness of the pad material. Replace pads if worn beyond the service limit.

Front Brake Pad Thickness
New .298″ / 7.6 mm
Service Limit .180″ / 4.6 mm
at Thinnest Location

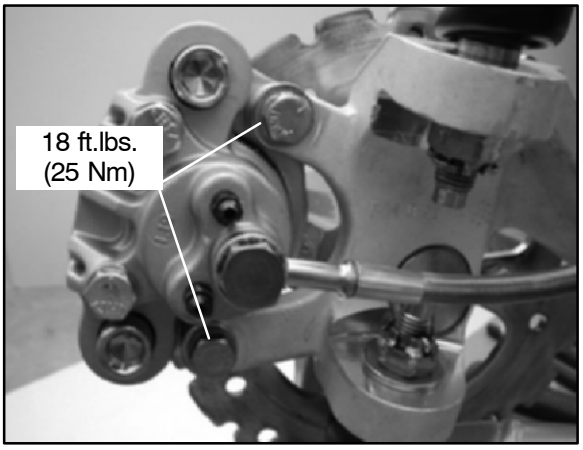
Friction Material
Minimum Thickness
.030” / .76 mm

FRONT PAD ASSEMBLY

1. Install pads with friction material facing each other. Install the slide bolts through the brake pads and tighten the slide bolts hand tight. Be sure pads and disc are free of dirt or grease.



2. Install caliper on the steering knuckle, and torque mounting bolts. (If previously removed.)



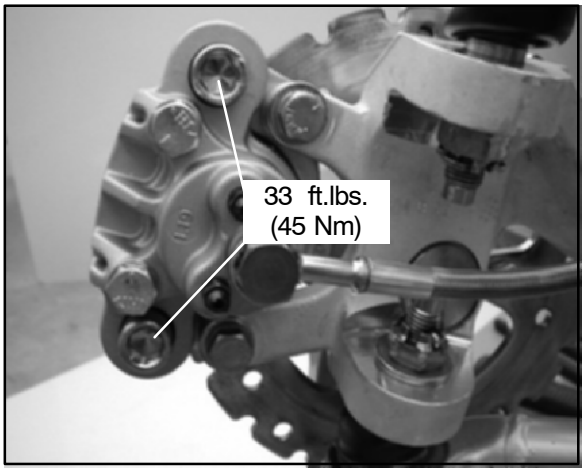
Front Caliper Mounting Bolts

Torque: 18 ft. lbs. (25 Nm)

3. Use an Allen wrench or socket to torque the front caliper slide bolts to **33 ft. lbs. (45 Nm)**.

Front Caliper Slide Bolts

Torque: 33 ft. lbs. (45 Nm)



4. Slowly pump the brake lever until pressure has been built up. Maintain at least 1/2″ (12.7 mm) of brake fluid in the reservoir to prevent air from entering the brake system.

5. Be sure fluid level in reservoir is between MIN and MAX lines and install reservoir cap.

Master Cylinder Fluid
Between MIN and MAX lines

6. Install wheels and torque wheel nuts.

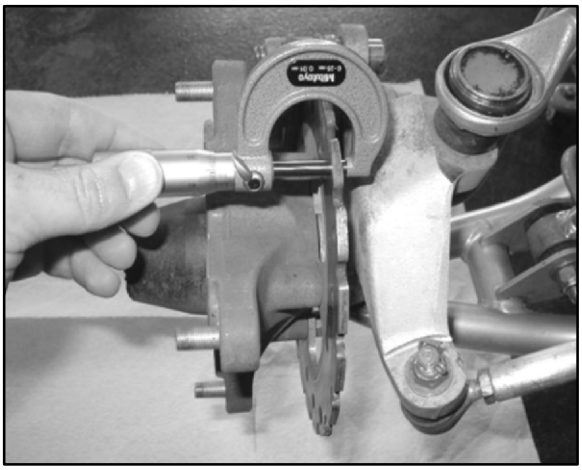
Front Wheel Nut Torque

20 ft. lbs. (28 Nm)

7. **BRAKE BURNISHING:** ***It is recommended that a burnishing procedure be performed after installation of new brake pads to extend service life and reduce noise. Start machine and slowly increase speed to 30 mph. Gradually apply brakes to stop machine. Repeat this procedure 10 times, allowing brakes to cool sufficiently after each run.***

FRONT DISC INSPECTION

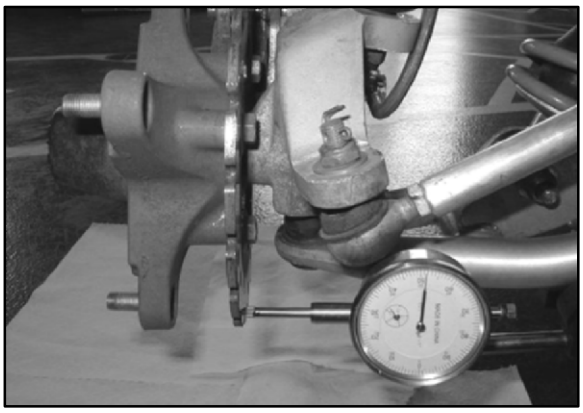
1. Visually inspect the brake disc for nicks, scratches, or damage.
2. Measure the disc thickness at 8 different points around the pad contact surface using a 0-1″ micrometer. Replace disc if worn beyond service limit.



Brake Disc Thickness
New .150-.164″ (3.810-4.166 mm)
Service Limit .140″ / 3.556 mm

Brake Disc Thickness Variance
Service Limit .002″ (.051 mm) difference between measurements.

3. Mount dial indicator as shown to measure disc runout. Slowly rotate the disc and read total runout on the dial indicator. Replace the disc if runout exceeds specifications.



Brake Disc Runout
Service Limit .010″ (.50 mm)

FRONT BRAKE DISC REMOVAL / REPLACEMENT

1. Apply heat to the hub in the area of the brake disc mounting bolts to soften the bolt locking agent.
2. Remove bolts and disc.
3. Clean mating surface of disc and hub.
4. Install disc on hub.

CAUTION: Always use new brake disc mounting bolts. The bolts have a pre-applied locking agent which is destroyed upon removal.

5. Install new bolts and tighten to specified torque.

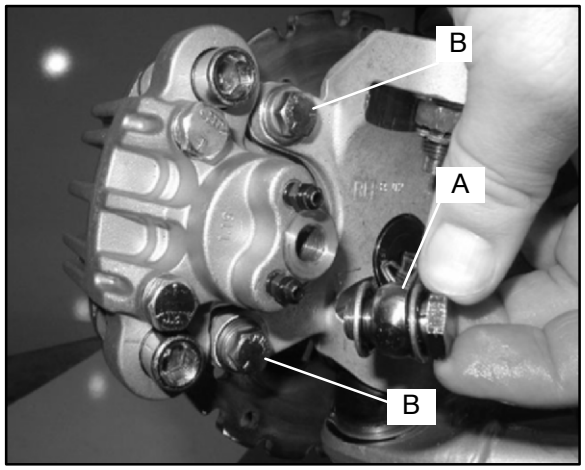
Front Brake Disc Mounting Bolt Torque
18 ft. lbs. (25 Nm)

FRONT CALIPER REMOVAL

CAUTION:

Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur if machine tips or falls.

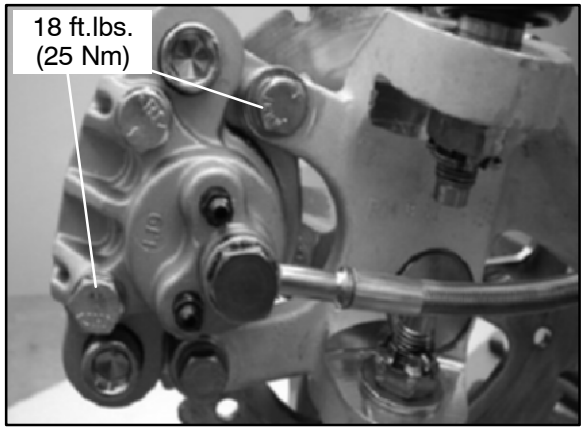
1. Remove brake pads. See Page 6.8.–6.9.



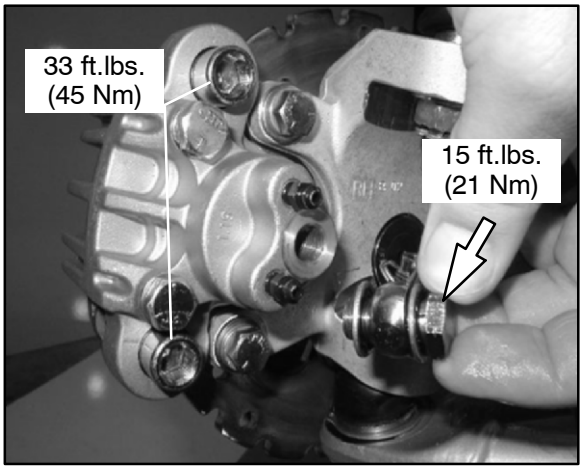
2. Using a line wrench, loosen and remove brake line (A) to caliper. Place a container under caliper to catch fluid draining from brake line. Drain the fluid into the container.
3. Remove the two brake caliper mounting bolts (B) and remove the brake caliper.

FRONT CALIPER INSTALL

1. Install caliper on hub strut, and torque mounting bolts to **18 ft.lbs. (25 Nm)**.



2. Install brake line and tighten securely with a line wrench.



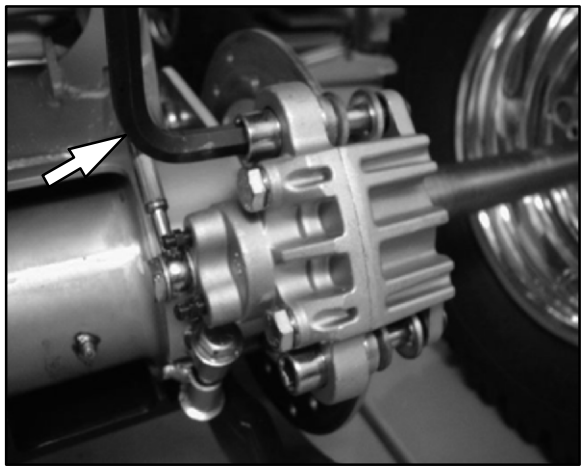
3. Torque the caliper slide bolts to **33 ft.lbs. (45 Nm)**. Torque the banjo line bolt to **15 ft.lbs. (21 Nm)**.
4. Follow brake bleeding procedure outlined on Pages 6.5-6.6.
5. Install wheels and torque wheel nuts to specification.

Front Wheel Nut Torque
20 ft. lbs. (28 Nm).

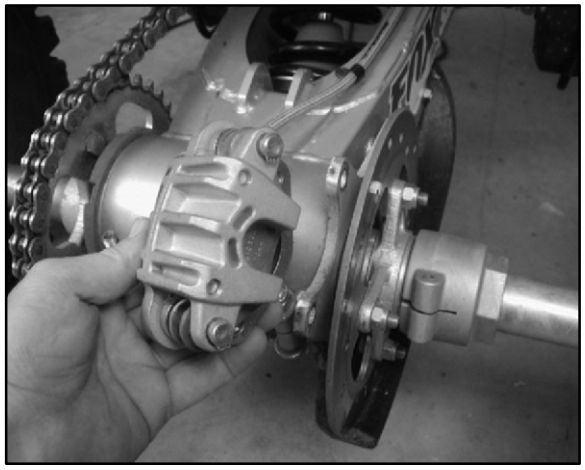
NOTE: BRAKE BURNISHING: ***It is recommended that a burnishing procedure be performed after installation of new brake pads to extend service life and reduce noise. Start machine and slowly increase speed to 30 mph. Gradually apply brakes to stop machine. Repeat this procedure 10 times, allowing brakes to cool sufficiently after each run.***

REAR BRAKE PAD REMOVAL

1. Loosen the caliper slide bolt with an Allen wrench before you remove the brake caliper.



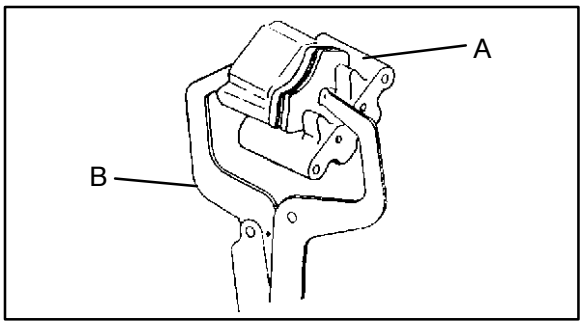
2. Remove caliper mounting bolts and lift caliper off of disc.



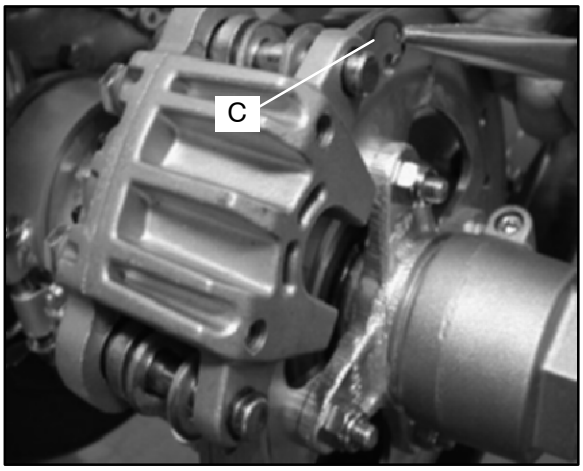
NOTE: When removing caliper, be careful not to damage brake line. Support caliper so as not to kink or bend brake line.

3. With pads installed, push caliper piston into caliper bore (A) slowly using a C-clamp (B) or locking pliers .

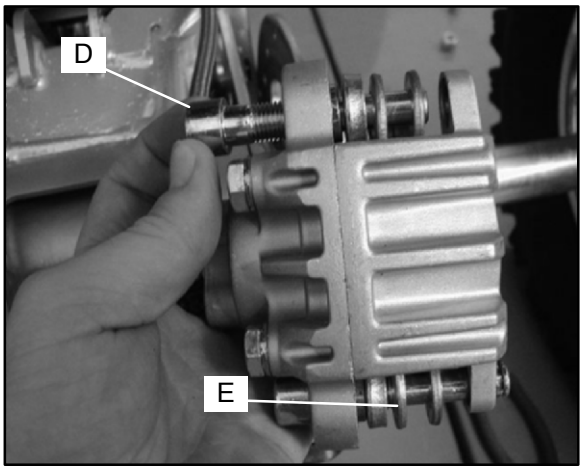
NOTE: Brake fluid will be forced through compensating port into master cylinder fluid reservoir when piston is pushed back into caliper. Remove excess fluid from reservoir as required.



4. Remove the c-clips (C) on the ends of the caliper slide bolt.

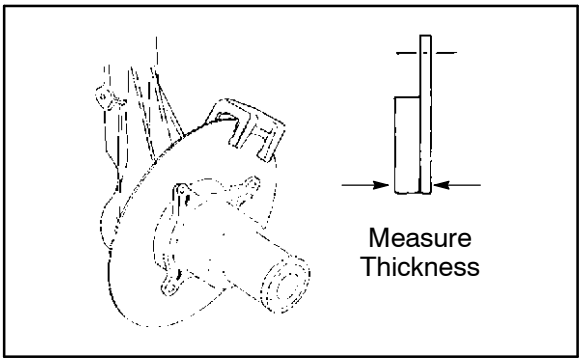


5. Remove caliper slide bolts (D) and brake pads (E).



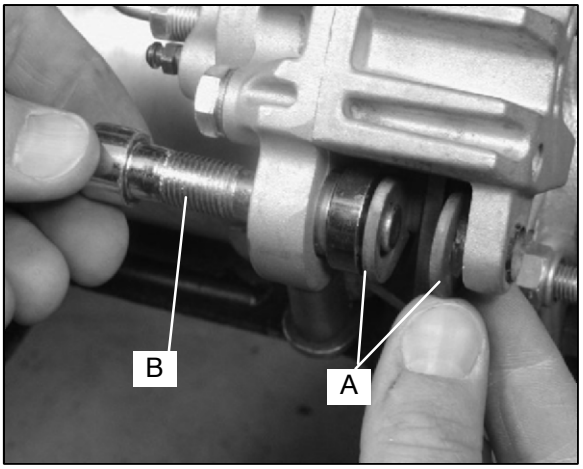
6. Measure the thickness of the pad material. Replace pads if worn beyond the service limit.

Front Brake Pad Thickness
New .298″ / 7.6 mm
Service Limit .180″ / 4.6 mm

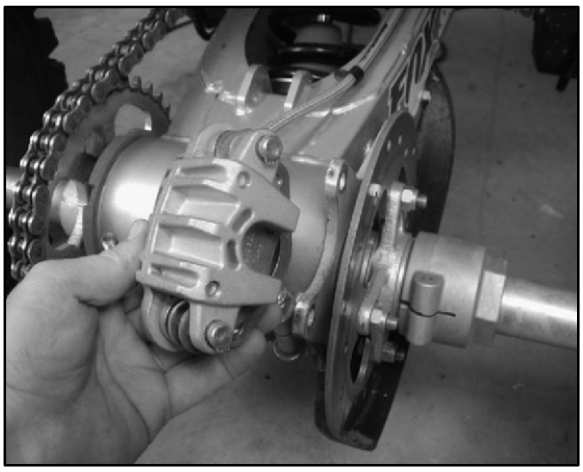


REAR BRAKE PAD INSTALLATION

1. Install new pads (A) in caliper body. Slide the caliper slide bolts (B) into the caliper and hand tighten.

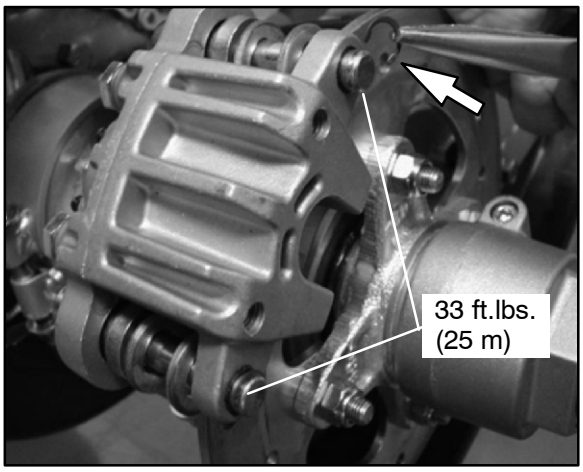


2. Install the caliper assembly over the brake disc and onto the caliper mount. Install the mounting bolts and torque mounting bolts to **18 ft. lbs. (25 Nm)**.



Brake Caliper Mounting Bolts
Torque:
18 ft. lbs. (25 Nm)

3. Torque the caliper slide bolts to **33 ft.lbs. (45 Nm)**. Install the c-clips onto the ends of the caliper slide bolts.



4. Slowly pump the brake levers until pressure has been built up. Maintain at least 1/2″ (12.7 mm) of brake fluid in the reservoir to prevent air from entering the master cylinder.

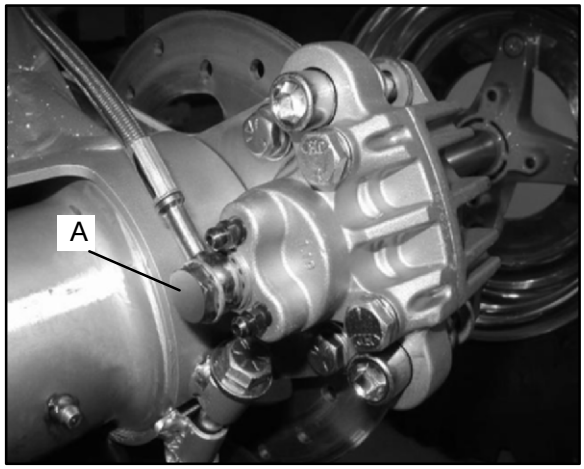
Auxiliary Brake Master Cylinder
Fluid Level
Between MIN and MAX lines

NOTE: BRAKE BURNISHING: ***It is recommended that a burnishing procedure be performed after installation of new brake pads to extend service life and reduce noise. Start machine and slowly increase speed to 30 mph. Gradually apply brakes***

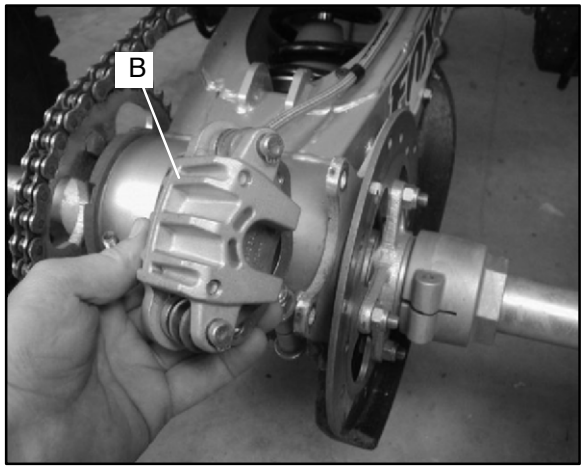
to stop machine. Repeat this procedure 10 times, allowing brakes to cool sufficiently after each run.

REAR CALIPER REMOVAL

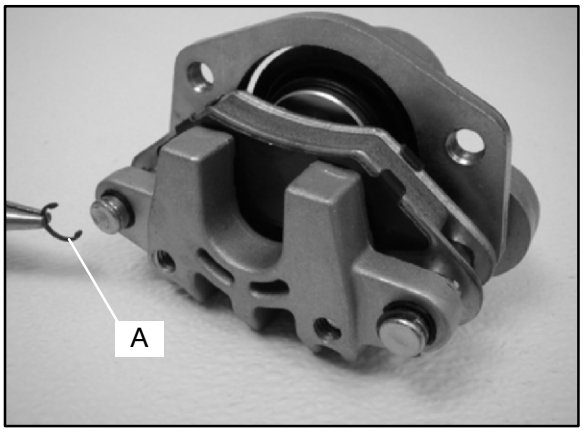
1. Clean caliper area before removal.
2. Using a flare nut wrench, remove the brake lines (A). Place a container to catch brake fluid draining from brake lines.



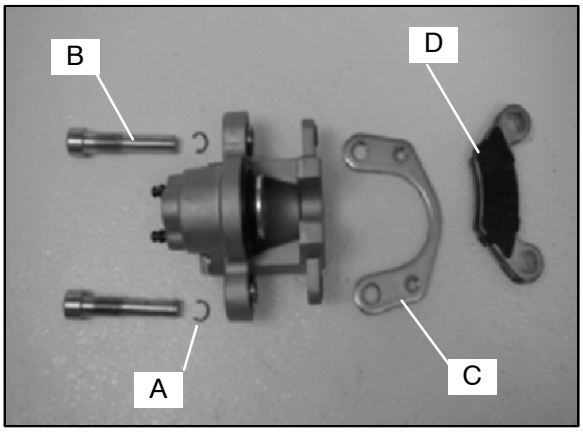
3. Remove the caliper mounting bolts and remove the caliper assembly (B) from the caliper mount.



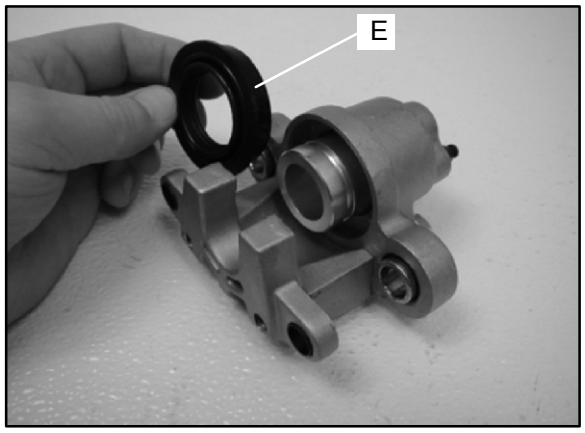
FRONT / REAR CALIPER DISASSEMBLY



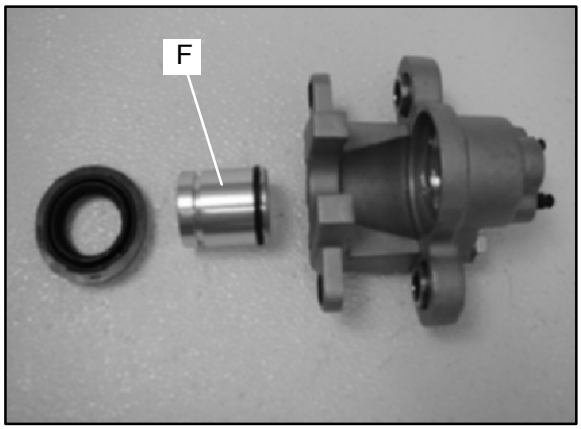
1. Remove the c-clips (A) from the caliper sliding bolts.
2. Remove the caliper slide bolts (B), mounting bracket (C), and brake pads (D).



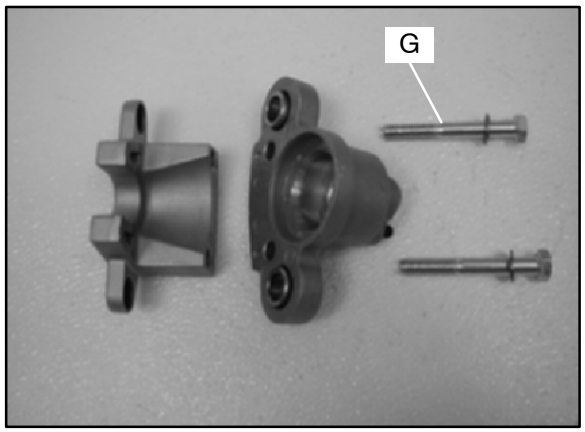
3. Remove the outside dust boot (E).



4. Remove the piston and dust seal (F).



5. Remove the caliper body bolts (G). Pull the caliper bodies apart (if necessary).

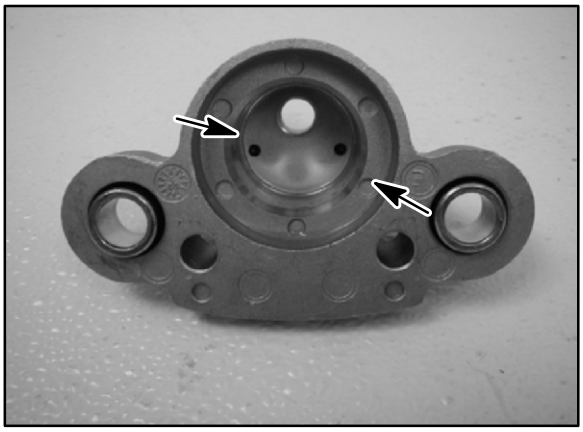


6. Clean the caliper body, piston, and retaining bracket with brake cleaner or alcohol.

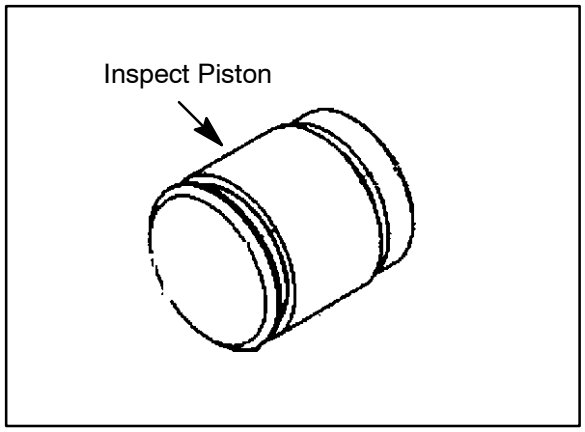
NOTE: Be sure to clean seal grooves in caliper body.

FRONT / REAR CALIPER INSPECTION

1. Inspect caliper body bore for nicks, scratches or wear. Measure bore for roundess. Replace if damage is evident.



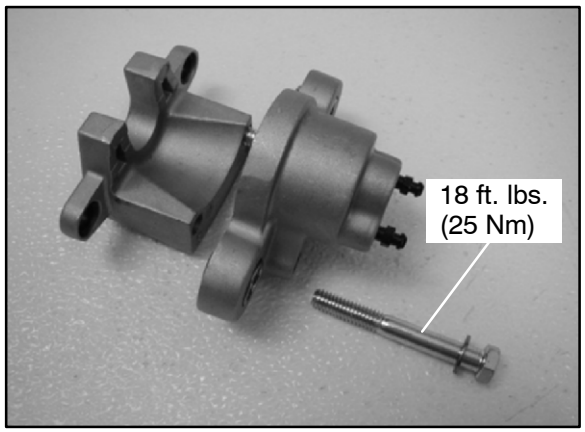
2. Inspect piston for nicks, scratches, wear or damage. Replace if damaged or worn.



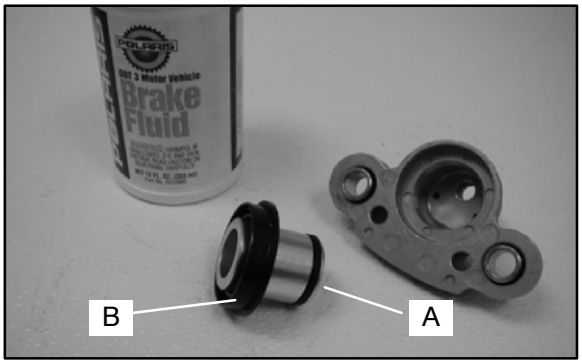
3. Inspect the brake disc and pads as outlined for brake pad replacement this section. See Page 9.9–9.11.

FRONT / REAR CALIPER ASSEMBLY

1. Reassemble the two caliper halves if previously disassembled. Torque the caliper body bolts to **18 ft.lbs. (25 Nm)**.

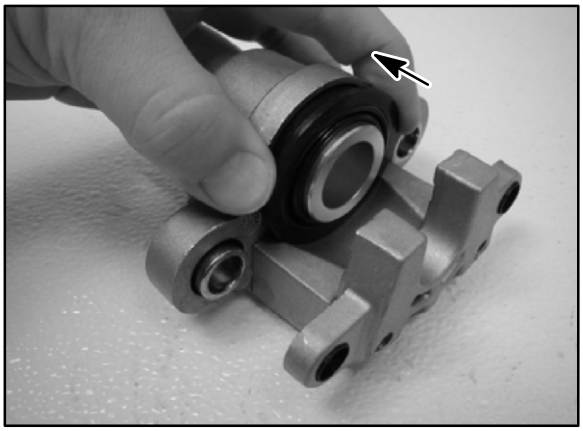


2. Install new O-ring (A) in the caliper body. Install the dust boot over the caliper and seat the dust boot into caliper groove. Be sure groove is clean and free of residue or brakes may drag.

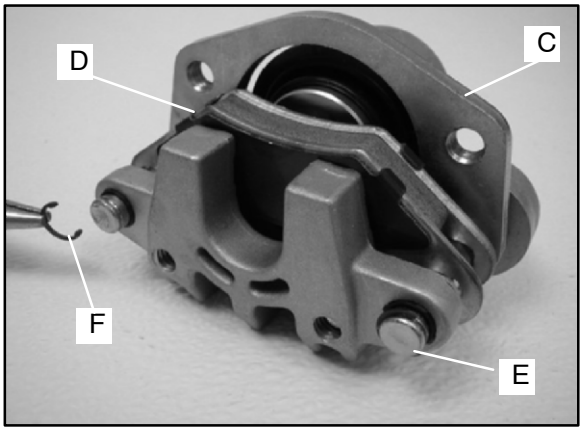


3. Coat piston and inside of caliper body with clean DOT 3 Brake Fluid (**PN 2870990**). Install piston with a twisting motion while pushing inward. Piston should slide in and out of bore smoothly, with light resistance.
NOTE: Be sure that the O-ring does not bind when installing the piston.

4. Seat the dust boot securely onto the caliper body.



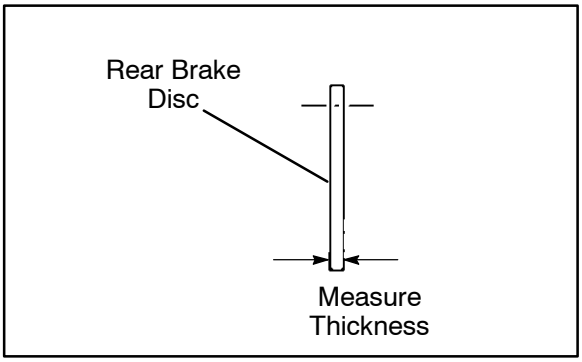
5. Install the caliper mount (C), brake pads (D), caliper slide bolts (E), and c-clips (F).



6. Torque the caliper slide bolts (E) to **33 ft.lbs. (45 Nm)**.

REAR BRAKE DISC INSPECTION

1. Visually inspect disc for scoring, scratches, or gouges. Replace the disc if any deep scratches are evident.



2. Use a 0-1″ micrometer and measure disc thickness at 8 different points around perimeter of disc. Replace disc if worn beyond service limit.

Brake Disc Thickness
New .150-.164″ (3.810-4.166 mm)
Service Limit .140″ / 3.556 mm

Brake Disc Thickness Variance
Service Limit .002″ (.051 mm) difference between measurements.

3. Mount dial indicator and measure disc runout. Replace the disc if runout exceeds specifications.

Brake Disc Runout
Service Limit .010″ (.25 mm)

TROUBLESHOOTING

Brakes Squeal

- Dirty/contaminated friction pads
- Improper alignment
- Worn disc
- Worn disc splines
- Glazed brake pads

Poor Brake Performance

- Air in system
- Water in system (brake fluid contaminated)
- Caliper/disc misaligned
- Caliper dirty or damaged
- Brake line damaged or lining ruptured
- Worn disc and/or friction pads
- Incorrectly adjusted lever
- Incorrectly adjusted stationary pad
- Worn or damaged master cylinder or components
- Improper clearance between lever and switch

Lever Vibration

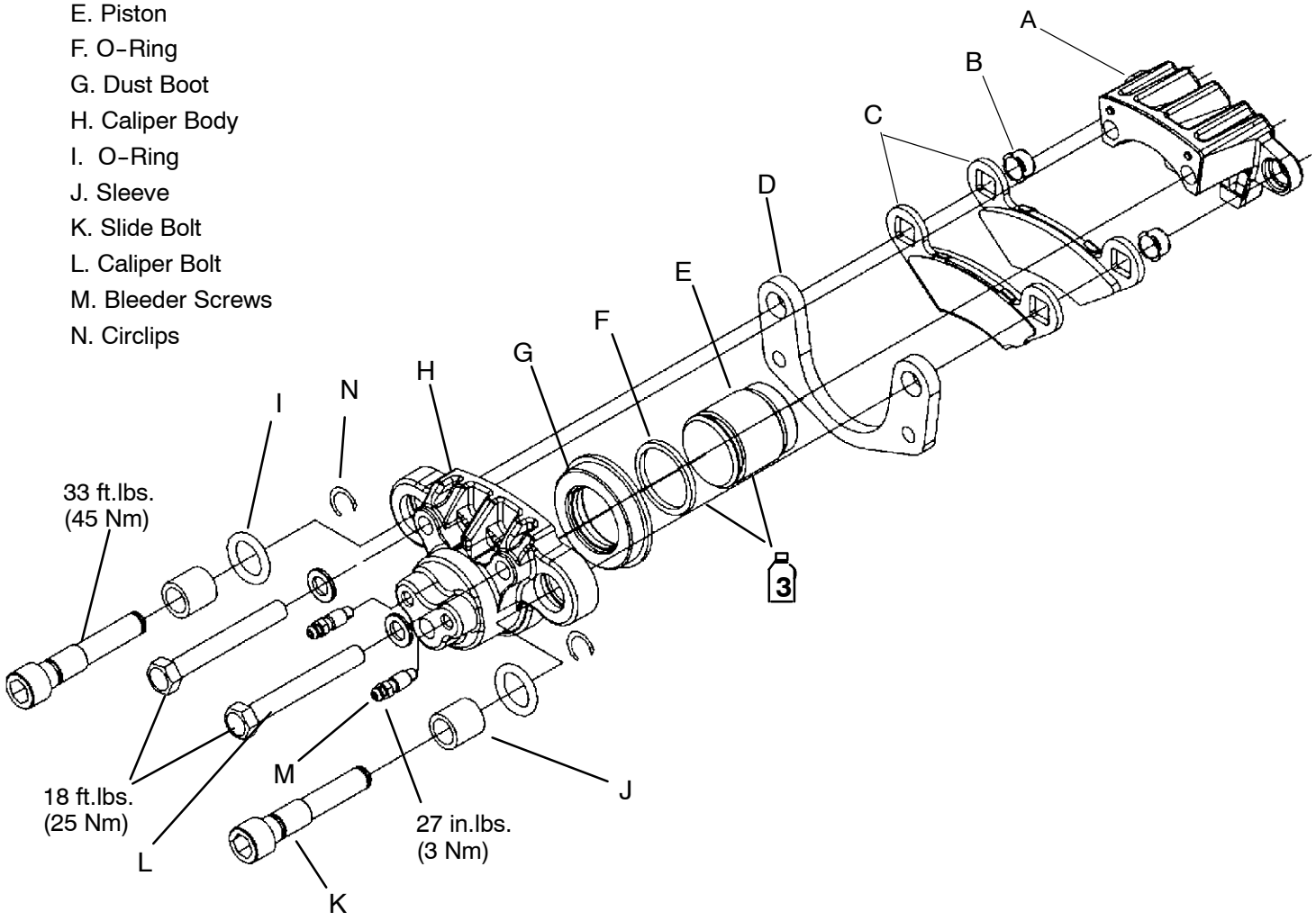
- Disc damaged
- Disc worn (runout or thickness variance exceeds service limit)
- Caliper Overheats (Brakes Drag)
- Compensating port plugged
- Pad clearance set incorrectly
- Auxiliary brake pedal incorrectly adjusted
- Brake lever or pedal binding or unable to return fully
- Parking brake left on
- Residue build up under caliper seals
- Operator riding brakes

Brakes Lock

- Alignment of caliper to disc
- Fluid overfill of the reservoir
- Stuck caliper piston

FRONT/REAR BRAKE CALIPER EXPLODED VIEW

A. Anvil Body
B. Bushing
C. Brake Pads
D. Caliper Bracket
E. Piston
F. O-Ring
G. Dust Boot
H. Caliper Body
I. O-Ring
J. Sleeve
K. Slide Bolt
L. Caliper Bolt
M. Bleeder Screws
N. Circlips

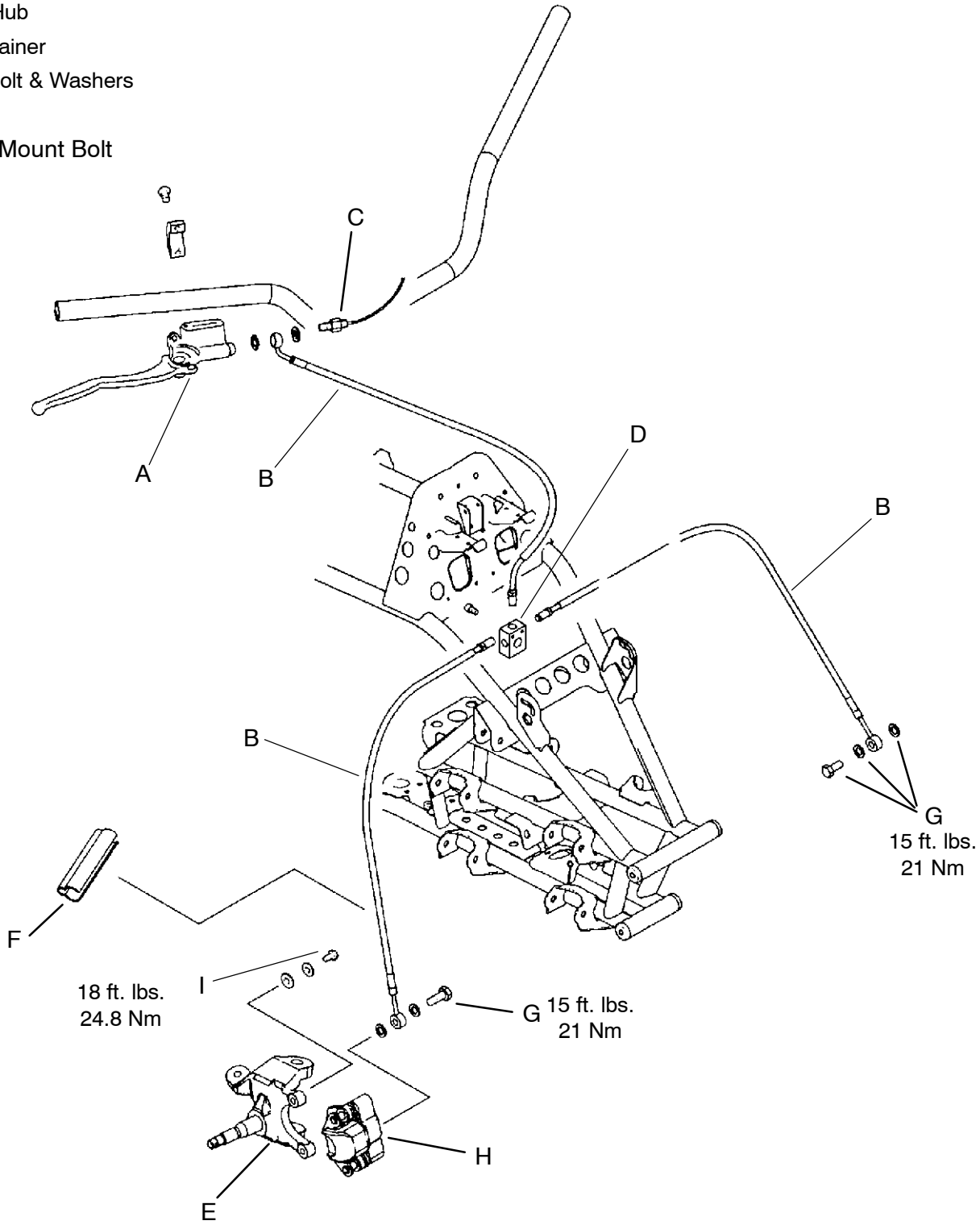


NOTE: BRAKE COMPONENTS ARE NOT SOLD SEPARATELY, REFER TO YOUR PARTS BOOK FOR PARTS BREAK DOWN.

3 APPLY POLARIS DOT 3 BRAKE FLUID TO COMPONENT

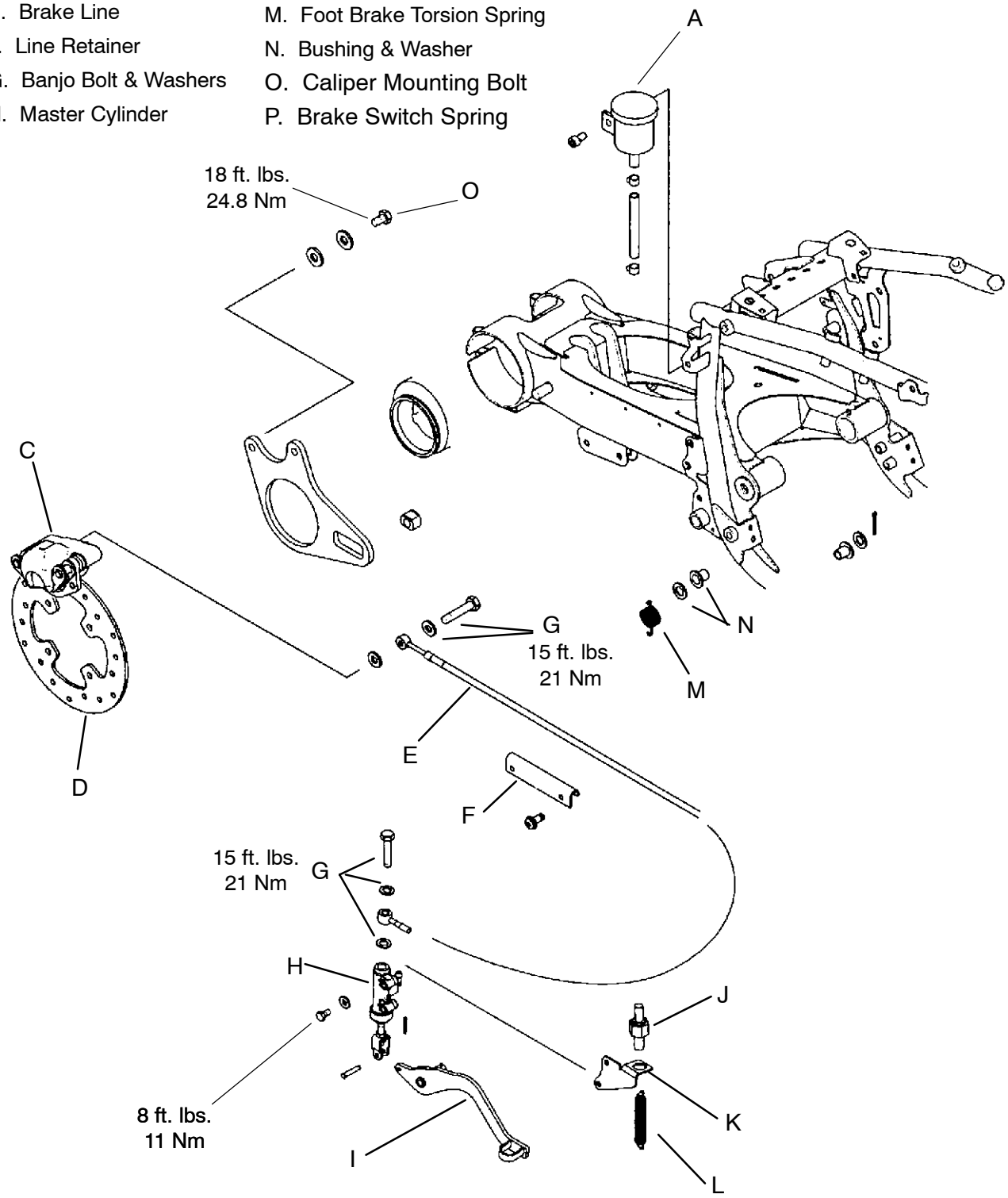
FRONT BRAKE SYSTEM – CALIPER/MASTER CYLINDER

A. Master Cylinder
B. Brake Line
C. Pressure Switch
D. Junction Box
E. Wheel Hub
F. Line Retainer
G. Banjo Bolt & Washers
H. Caliper
I. Caliper Mount Bolt



REAR BRAKE SYSTEM - CALIPER/MASTER CYLINDER

A. Reservoir
B. Caliper Mount
C. Rear Caliper
D. Brake Disc
E. Brake Line
F. Line Retainer
G. Banjo Bolt & Washers
H. Master Cylinder
I. Foot Brake
J. Switch
K. Mount Bracket
L. Brake Pedal Return Spring
M. Foot Brake Torsion Spring
N. Bushing & Washer
O. Caliper Mounting Bolt
P. Brake Switch Spring



NOTES

CHAPTER 7
ELECTRICAL

SPECIAL TOOLS

PART NUMBER	TOOL DESCRIPTION
PV-43568	Fluke™ 77 Digital Multimeter
2870630	Timing Light
2870836	Battery Hydrometer
2871745	Static Timing Light Harness

ELECTRICAL SERVICE NOTES

Keep the following notes in mind when diagnosing an electrical problem.

- Refer to wiring diagram for stator and electrical component resistance specifications.
- When measuring resistance of a component that has a resistance value under 10 Ohms, remember to subtract meter lead resistance from the reading. Connect the leads together and record the resistance. The resistance of the component is equal to tested value minus the lead resistance.
- Become familiar with the operation of your meter. Be sure leads are in the proper jack for the test being performed (i.e. 10A jack for current readings). Refer to the Owner's manual included with your meter for more information.
- Voltage, amperage, and resistance values included in this manual are obtained with a Fluke™ 77 Digital Multimeter (**PV-43568**). This meter is used for when diagnosing electrical problems. Readings obtained with other meters may differ.
- Pay attention to the prefix on the multimeter reading (K, M, etc.) and the position of the decimal point.
- For resistance readings, isolate the component to be tested. Disconnect it from the wiring harness or power supply.

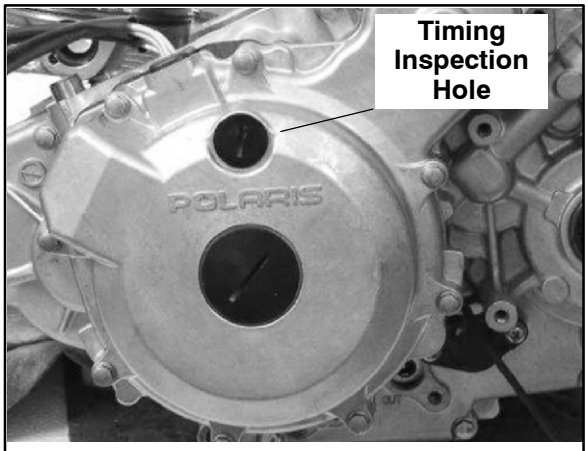
TIMING CHECK PROCEDURE

1. The ignition timing check hole is in the starter recoil/magneto housing. Remove the check plug.

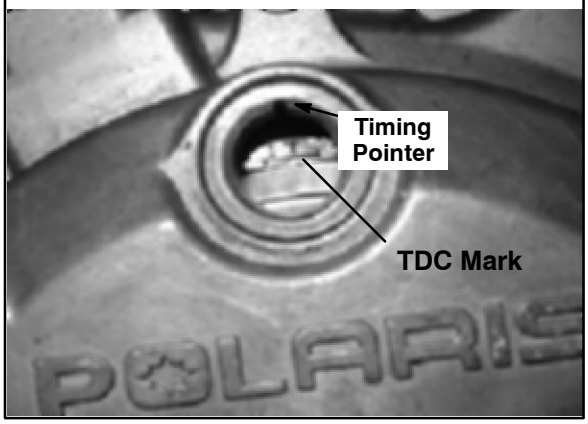
The ignition timing marks are stamped on the outer diameter of the flywheel. Ignition timing must be inspected with the engine at room temperature (68°F / 20° C) to obtain the most accurate reading.

2. With the transmission in neutral, start the engine and set engine speed to 3500 ± 50 RPM.
3. Direct the timing light at the ignition timing check hole and check the ignition timing. **NOTE:** Do not allow the engine to warm up. The timing may retard approximately 2° when the engine is warm.

If the ignition timing is not within the specified range, test components for proper function.



Predator 500 Timing: Max 30° @ 3500 RPM



NEUTRAL POSITION INDICATOR SWITCH TEST

1. Verify that the transmission is in neutral and the key is off. Connect an ohm meter lead to the switch lead and one to engine ground. Meter resistance should read in megaohms or no continuity.
2. Shift the transmission into gear. The ohm meter should show continuity.
3. If there is no continuity with the transmission in gear, remove the switch and re-test manually. Inspect the shift drum contact pin and spring for proper function. If no problems are found, inspect the wiring, bulb and harness connections.

COOLANT TEMPERATURE SENSOR TEST (HOT LIGHT)

With the ignition switch (and engine stop switch) "ON", power is delivered to the hot light via the Red/White wire. The Blue/White wire (ground) out of the light socket is connected to the coolant temperature sensor on the cylinder head. In normal operating conditions, the temperature sensor is non-conductive (open). If engine coolant reaches the specified temperature, the sensor becomes conductive completing the ground path for the light.

With engine cold, disconnect lead and measure resistance of sensor between connector terminal and ground. There should be no continuity or very high resistance (megohms).

Hot Light On	221° F (105° C)

FAN CONTROL CIRCUIT OPERATION / TESTING

The fan switch is located on the radiator. Power is supplied to the fan switch via the Red/Black wire when the ignition key is ON. When the fan switch reaches the specified temperature, it becomes conductive and sends power to the fan motor through to the Orange/Black wire. The ground path for the fan motor is through the Brown harness wire.

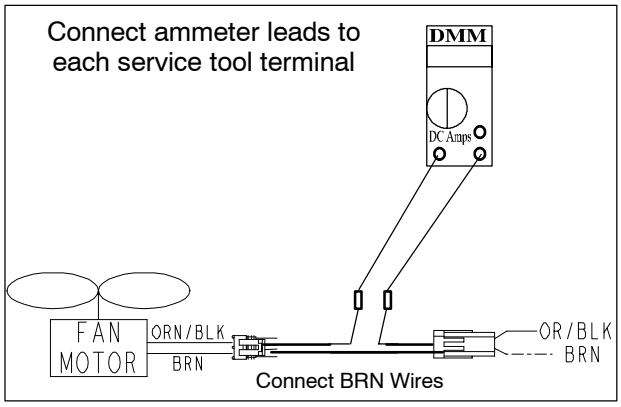
CAUTION: ***Keep hands away from fan blades during this procedure. Serious personal injury could result.***

The fan switch may not function or operation may be delayed if coolant level is low or if air is trapped in the cooling system. Be sure cooling system is full and purged of air. Refer to Maintenance Chapter 2 for cooling system information.

FAN CONTROL SWITCH BYPASS TEST

1. Disconnect harness from fan switch on radiator.
2. Place a jumper wire between the Red/Blk and Org/Blk wires in the connector.
3. With the parking brake on, turn the ignition key (and engine stop switch) "ON". The fan should start running.
4. If the fan runs with the jumper wire installed, check the fan control switch and connector terminals. If the fan does not run or runs slowly with the jumper wire installed, check the fan motor wiring, ground, and motor condition (refer to Fan Motor Current Draw). Repair or replace as necessary.

FAN MOTOR CURRENT DRAW



A current draw test will provide a good indication of fan motor condition. A worn or damaged fan motor will draw more current, which causes a reduction in blade speed and reduced cooling.

1. Turn key to off. Disconnect harness from fan switch on radiator.
2. Place a jumper wire between the Red/Blk and Org/Blk wires in the fan switch connector.
3. Disconnect the fan and place a jumper wire between the brown wires in the connectors. This will provide a ground path to the fan.
4. Place a DC ammeter in series as shown in the Illustration.
5. Be sure fan blade is free to rotate.

6. Turn ignition key and engine stop switch to “RUN” position. Read the current draw on ammeter with fan running.
7. During start-up, the amperage should peak then decline rapidly. If the motor continues to draw more amperage than the fan circuit breaker rating during start-up, replace the motor.
8. If the fan motor draws more than 6.5 Amps during continual running, replace the motor.

Fan Motor Current Draw:

Less Than 6.5 Amps

COOLANT FAN CONTROL SWITCH OPERATION TEST

1. Place switch in a liquid bath and submerse it to the base of the threads. Do not allow threads to contact container or inaccurate reading will result.
2. Heat the liquid slowly and monitor the temperature with a thermometer or Fluke™ meter pyrometer. The switch should be closed (conductive) at the “ON” temperature indicated in the chart, and stay conductive until the “OFF” temperature is reached.

REFER TO PARTS MANUAL FOR FAN SWITCH APPLICATION		
Fan Switch Type	**Continuity (On)**	**No Continuity (Off)**
Off/On Thermistor	180° F (82° C) ± 3°F	150° F (65° C) ± 8°F

ELECTRONIC THROTTLE CONTROL (ETC) SWITCH

The Electronic Throttle Control (ETC) system is designed to stop the engine of an ATV in the event of a mechanical problem with the throttle mechanism. The ETC switch is mounted independently of the throttle actuator lever inside the throttle block assembly. This is a *normally closed* switch, and is held in the open position (contacts are separated (as shown below) by throttle cable tension. The contacts are “open” during normal operation regardless of throttle lever position. In the event of a mechanical problem in the throttle mechanism (cable tension is lost), the switch contacts close, connecting the CDI black wire to ground, which prevents ignition spark. This is the same as turning the key or engine stop switch “OFF”.

Test the ETC switch at the harness connector. **NOTE:** Adjust throttle cable freeplay (ETC switch) and make sure throttle mechanism is functioning properly before testing the switch. Refer to Maintenance Chapter 2 for cable adjustment procedure.

ETC OPERATION TEST

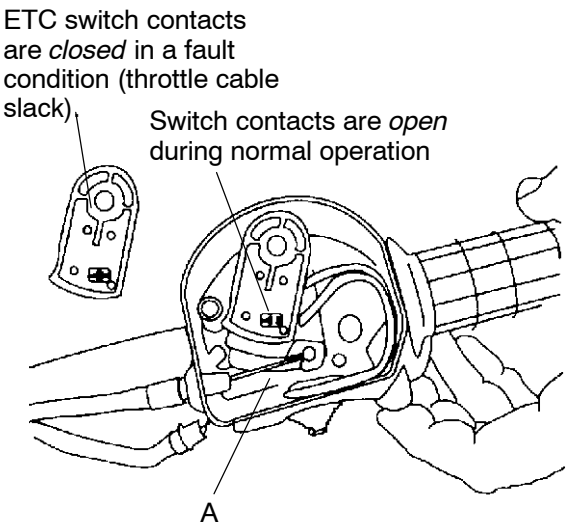
Remove throttle block cover by carefully releasing all tabs around edge of cover.

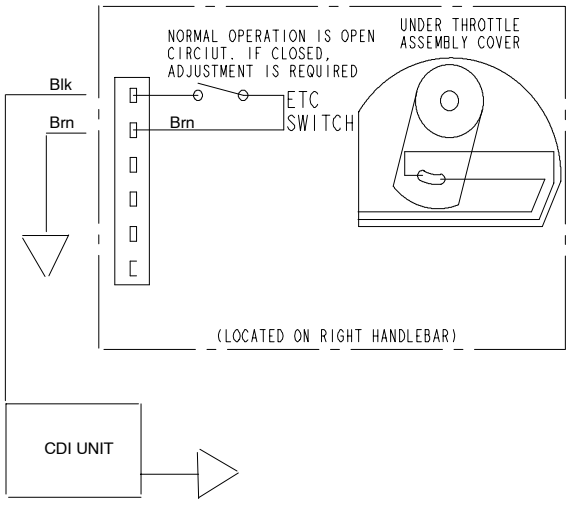
Place transmission in neutral and apply parking brake.

Start engine and open throttle lever slightly until engine RPM is just above idle speed.

Hold throttle cable with fingers at point “A” as shown below and release throttle lever. If the ETC system is functioning properly, the engine will lose spark and stop.

Electronic Throttle Control (ETC) Switch
(Composite Throttle Housing)





IGNITION SYSTEM TROUBLESHOOTING

No Spark, Weak or Intermittent Spark

- No12 volt power or ground to CDI
- Spark plug gap incorrect
- Fouled spark plug
- Faulty spark plug cap or poor connection to high tension lead
- Related wiring loose, disconnected, shorted, or corroded
- Engine Stop switch or ignition switch faulty
- ETC switch misadjusted or faulty
- Poor ignition coil ground (e.g. coil mount loose or corroded)
- Faulty stator (measure resistance of all ignition related windings)
- Incorrect wiring (inspect color coding in connectors etc)
- Faulty ignition coil winding (measure resistance of primary and secondary)
- Worn magneto (RH) end Crankshaft bearings
- Sheared flywheel key
- Flywheel loose or damaged
- Excessive crankshaft runout on magneto (RH) end - should not exceed .005″
- Faulty CDI module

CRANKING OUTPUT TEST WITH PEAK READING VOLTMETER

The following peak voltage tests will measure the amount of output directly from each component. A peak reading voltmeter must be used to perform the tests. A variety of peak reading adaptors are commercially available for use with the Fluke™ 77 Digital Multimeter **(PV-43568),** which will allow peak voltage tests to be performed accurately. Follow the directions provided with the adaptor. All measurements are indicated in DC Volts. Readings obtained without a peak reading adaptor will be significantly different.

Test output from the CDI and pulse (trigger) coil and compare to the table. The following measurements are obtained when cranking the engine with the electric starter, spark plug installed. The starter system must be in good condition and the battery fully charged.

200 Watt 4 Stroke DC/CDI Ignition

Test	Connect Meter Wires To:	Reading (Without Peak Reading Volt meter)
Pulse (Trigger)	White/Red and White	3.3 DCV

CDI OUTPUT TEST USING PEAK READING ADAPTOR

Re-connect all CDI wires to stator wires. Disconnect CDI module wire from ignition coil primary terminal. Connect one meter lead to engine ground and the other to the ignition coil primary wire leading from the CDI module. Set meter to read DC Volts. Crank engine and check output of CDI wire to coil. Reconnect CDI wire to coil.

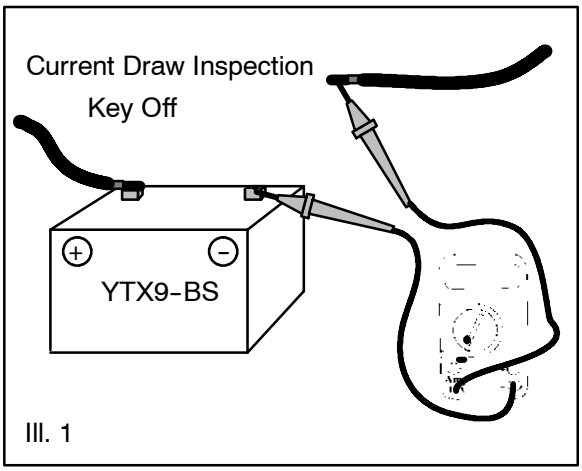
Output w/ Peak output tester
130 DCV
Average Output w/ Digital Voltmeter
20 DCV

CURRENT DRAW - KEY OFF

CAUTION: Do not connect or disconnect the battery cable or ammeter with the engine running. Damage will occur to electrical components.

Connect an ammeter in series with the negative battery cable. Check for current draw with the key off. If the draw is excessive, loads should be disconnected from the system one by one until the draw is eliminated. Check component wiring as well as the component for partial shorts to ground to eliminate the draw.

Refer to Illustration 1 on the next page.



Ill. 1

Current Draw - Key Off:
Maximum of .01 DCA (10 mA)

CHARGING SYSTEM "BREAK EVEN" TEST

CAUTION: ***Do not allow the battery cable or ammeter to become disconnected with the engine running. Follow the steps below as outlined to reduce the chance of damage to electrical components.***

WARNING: Never start the engine with the ammeter connected in series. Damage to the meter or meter fuse will result. Do not run test for extended period of time. Do not run test with high amperage accessories.

The "break even" point of the charging system is the point at which the alternator overcomes all system loads (lights, etc.) and begins to charge the battery. Depending on battery condition and system load, the break even point may vary slightly. The battery should be fully charged before performing this test.

1. Connect a tachometer according to manufacturer's instructions.
2. With the negative cable still connected to the battery, connect one meter lead (set to DC amps) to the negative battery post and the other to the negative battery cable
3. With engine off and the key and kill switch in the ON position, the ammeter should read negative amps (battery discharge). Reverse meter leads if a positive reading is indicated.
4. Shift transmission into neutral and start the engine. *With the engine running at idle, disconnect the negative cable from the battery post without disturbing the meter leads.* Observe meter readings
5. Increase engine RPM while observing ammeter and tachometer.
6. Note RPM at which the battery starts to charge (ammeter indication is positive).
7. With lights and other electrical load off, the "break even" point should occur at approximately 1500 RPM or lower.
8. Turn the lights on and engage parking brake lock to keep brake light on.
9. Repeat test, observing ammeter and tachometer. With lights on, charging should occur at or below 2000 RPM.

ALTERNATOR OUTPUT TEST (AC AMP)

This test measures AC amperage from the alternator.

CAUTION: This test simulates a "full load" on the alternator at idle. Do not increase idle RPM or perform this test longer than required to obtain a reading. The alternator stator windings may overheat. 3-5 seconds is acceptable.

To Calculate Available Alternator Output

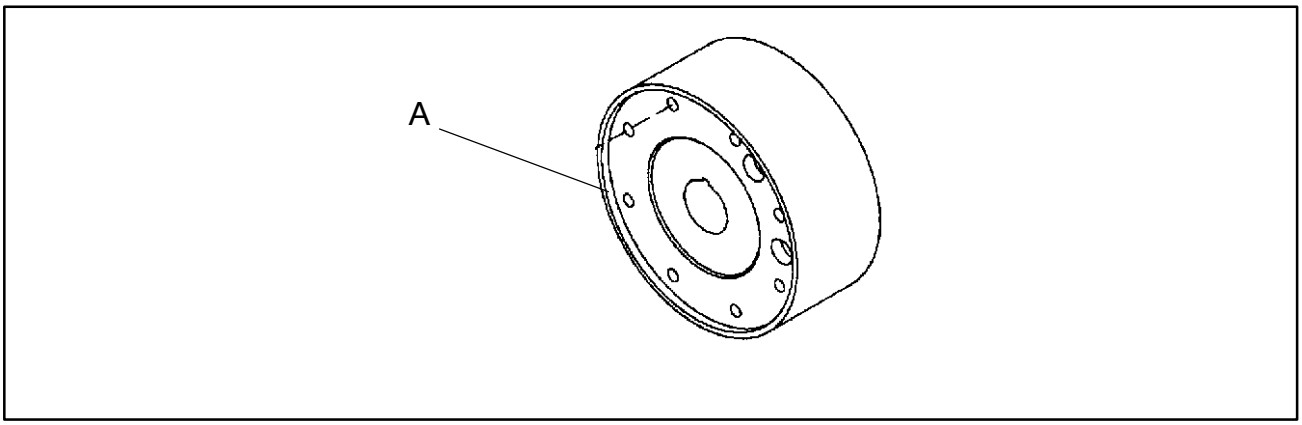
$$I = \frac{P}{E} \qquad \frac{200W}{12V} = 16.7 \text{ Amps} \qquad \frac{250W}{12V} = 20.8 \text{ Amps}$$

I = Current in Amps
P = Power in Watts
E = Electromotive Force (Volts)

1. Maximum alternator output will be indicated on the meter. DO NOT increase engine RPM above idle.
2. Place the red lead on the tester in the 10A jack.
3. Turn the selector dial to the AC amps position.
4. Connect the meter leads to the Yellow and Yellow/Red wires leading from the alternator.
5. Start the engine and let it idle. Reading should be a minimum of 5A/AC at idle.

Alternator Current Output:
Minimum of 5 AC Amps at Idle

FLYWHEEL IDENTIFICATION



Flywheel Identification Stamp Location

The flywheel can be identified by the casting marks in location A. Refer to "I.D." location in chart below.

2003 Engine Application	Type	Stamp	Comment	I.D. Stamp
ES50PL	External Trigger	IJ09	DC/CDI Ign	K1805

PREDATOR DC / CDI IGNITION

The Predator has incorporated into it's design a DC/ CDI ignition system.

Some of the advantages of DC ignition are:

- Stronger, more consistent spark at low rpm for better performance
- Easier starts
- Simpler component design for ease trouble shooting and maintenance

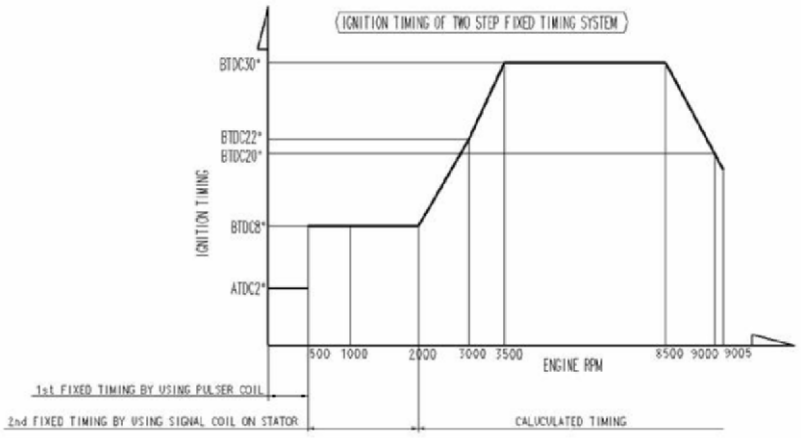
Operation Overview:

The DC/CDI system relies on battery power for ignition function. Instead of generating DC voltage via magnetic induction, a 12 volt DC current is supplied directly to the CDI unit from the battery.

At the CDI, the supplied 12 volt DC current charges an internal capacitor to build up the initial ignition charge. A small A/C signal from the Pulse coil closes a thyristor (located in the CDI) at a point pre-determined in the crankshaft rotation by magnets on the flywheel's outer diameter. This signal releases the electrical charge which saturates the coil for ignition. DC/CDI systems have the ability to ignite with as little as 6 volts of power.

NOTE:

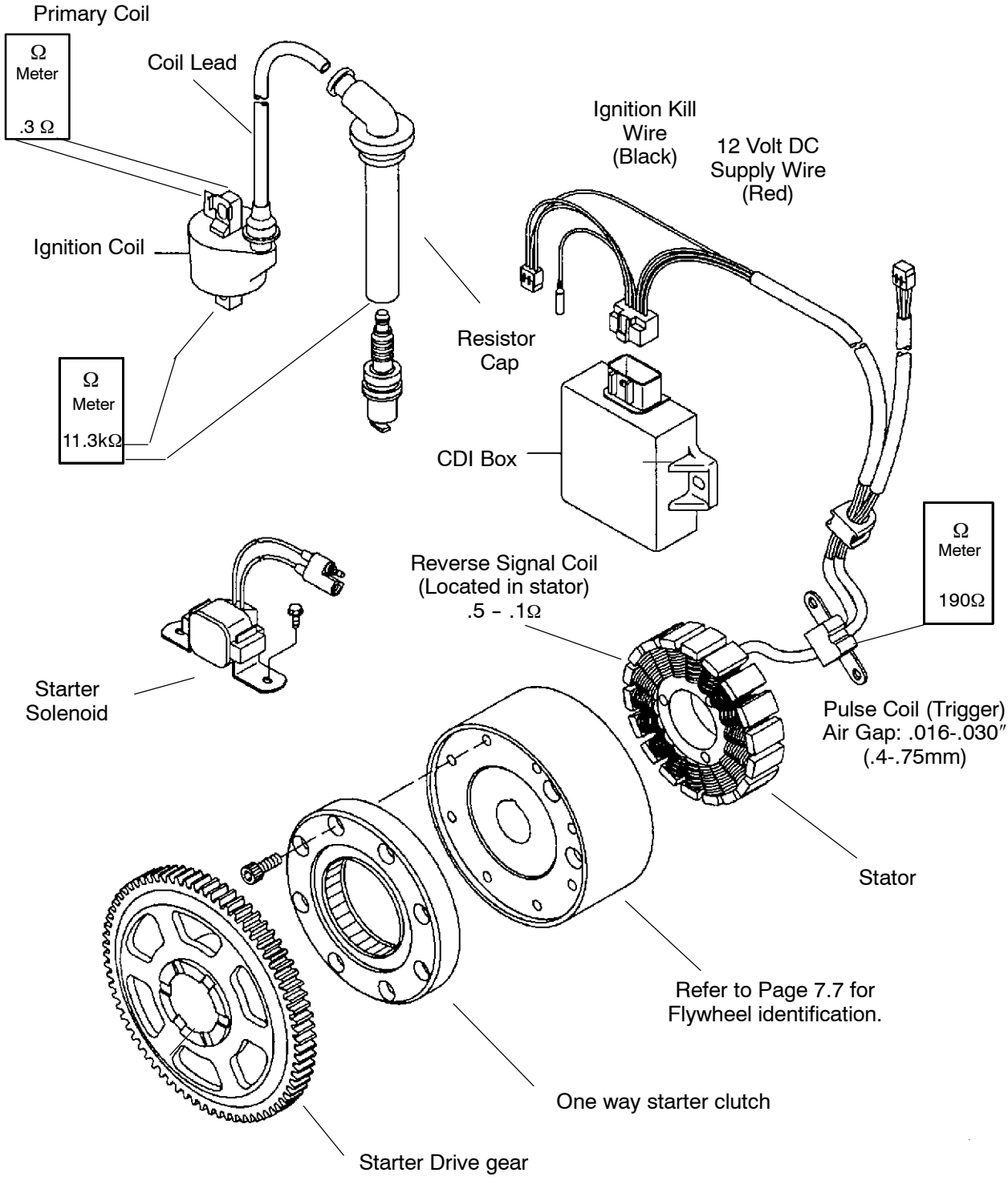
DC/CDI systems and components are not interchangeable with any other system.



COMPONENTS OF ES50PL ALTERNATOR DC/CDI IGNITION

Note: DC/CDI components are not compatible with any other type of ignition

Refer To Wiring Diagrams For Specified Stator Coil Resistance

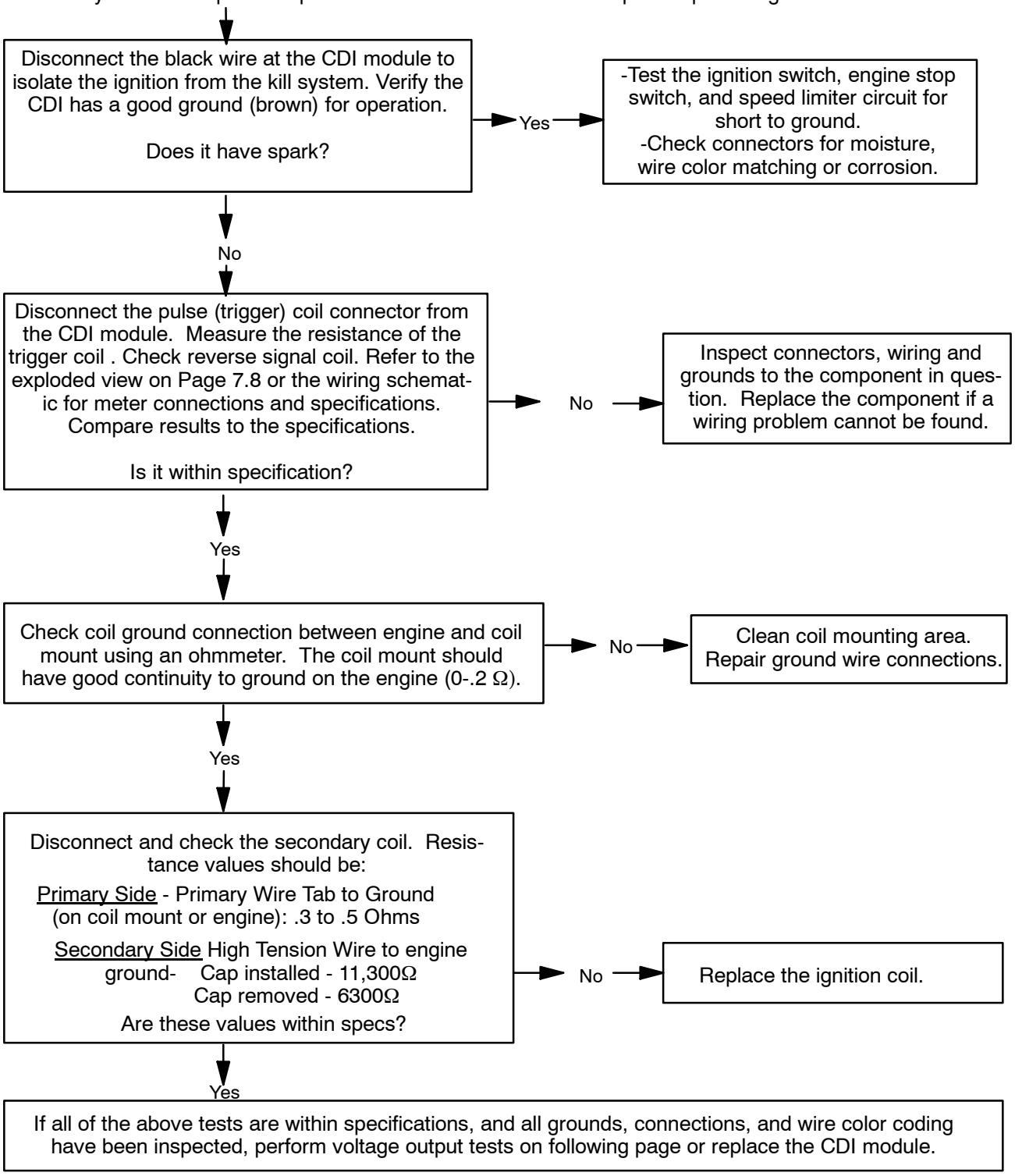


IGNITION SYSTEM TESTING

Whenever troubleshooting an electrical problem you should first check all terminal connections to be sure they are clean and tight. Also be sure that colors match when wires are connected. Use the following pages as a guide for troubleshooting. The resistance values are also given on the specification pages.

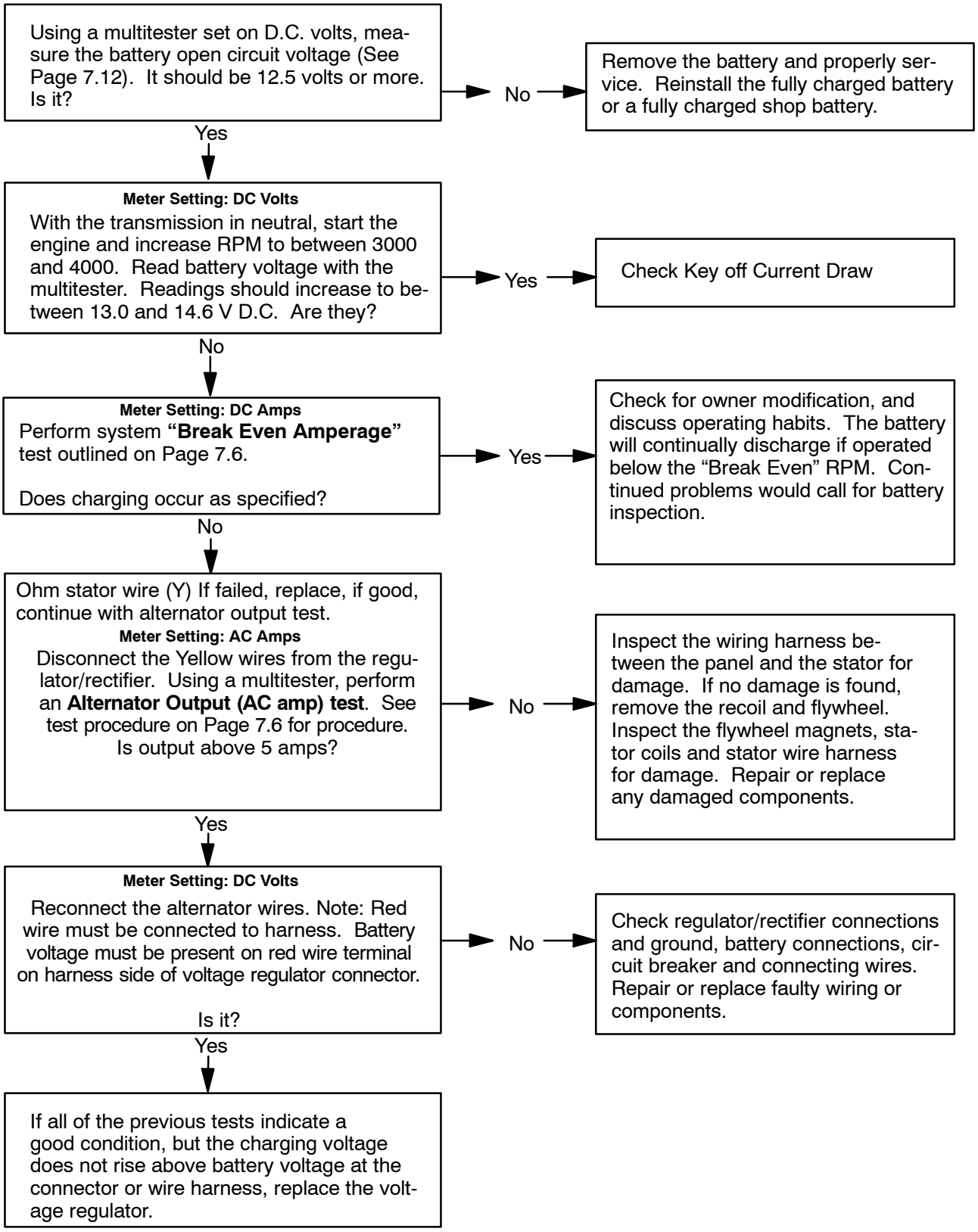
Condition: No Spark or intermittent spark

Verify 12 Volt DC power is present on the red wire to CDI . Replace Spark Plug.



CHARGING SYSTEM TESTING FLOW CHART

Whenever charging system problems are suspected, proceed with the following system check.



BATTERY MAINTENANCE

⚠ WARNING

Battery electrolyte is poisonous. It contains sulfuric acid. Serious burns can result from contact with skin, eyes or clothing. Antidote:

External: Flush with water.

Internal: Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Call physician immediately.

Eyes: Flush with water for 15 minutes and get prompt medical attention.

Batteries produce explosive gases. Keep sparks, flame, cigarettes, etc. away. Ventilate when charging or using in an enclosed space. Always shield eyes when working near batteries. KEEP OUT OF REACH OF CHILDREN.

The battery is located under the left rear fender.

All Predator ATV batteries are Maintenance-Free design and construction. Before placing the battery into service, check the battery condition and charge accordingly. Use of Conventional Lead-Acid batteries is not recommended.

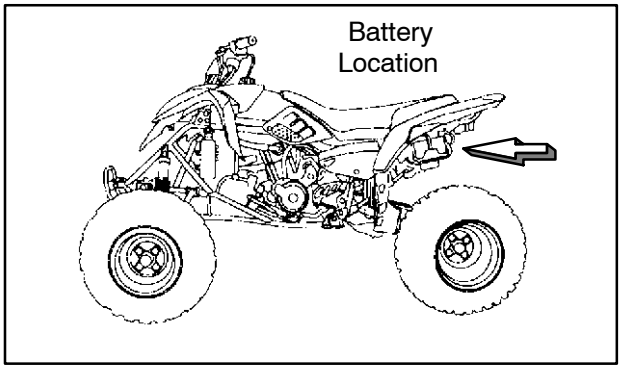
New Batteries: Batteries must be fully charged before use or battery life will be reduced by 10-30% of full potential. Charge battery for 3-5 hours at a current equivalent of 1/10 of the battery's rated amp/hour capacity (i.e. 9 amp hr x .10 = .9 amp charging). Do not use the alternator to charge a new battery.

Maintenance-Free batteries are sealed at the factory. The use of lead-calcium instead of lead-antimony allows the battery acid to be fully absorbed by the plates. Therefore, a Maintenance-Free battery case is opaque and the sealing caps are not removable, since there is no need to check electrolyte level.

NEVER attempt to add electrolyte or water to a Maintenance-Free battery. Doing so will damage the case and shorten the life of the battery. Refer to the Battery Maintenance Video (PN 9917987) for proper instruction on servicing Maintenance-Free batteries.

BATTERY INSPECTION/REMOVAL

The battery is located under the left rear fender.



To remove the battery:

1. Disconnect holder strap.
2. Disconnect battery negative (-) (black) cable first, followed by the positive (+) (red) cable.

⚠ CAUTION

To reduce the chance of sparks: Whenever removing the battery, disconnect the negative (black) cable first. When reinstalling the battery, install the negative cable last.

3. Remove the battery.
4. Clean battery cables and terminals with a stiff wire brush. Corrosion can be removed using a solution of one cup water and one tablespoon baking soda. Rinse well with clean water and dry thoroughly. Test battery for condition and charge accordingly.
5. Reinstall battery, attaching positive (+) (red) cable first and then the negative (-) (black) cable.
6. Coat terminals and bolt threads with Dielectric Grease (**PN 2871329**).
7. Reinstall battery cover and holder strap.
8. Reinstall the battery caps.
9. Charge battery at 1/10 of its amp/hour rating. Example: 1/10 of 14 amp battery = 1.4 amp
10. Reinstall the battery after testing.

BATTERY TERMINALS/BOLTS

Use Polaris corrosion resistant Dielectric Grease (**PN 2871329**) on battery bolts.

BATTERY TESTING

Whenever a service complaint is related to either the starting or charging systems, the battery should be checked first.

Following are tests which can easily be made on a maintenence-free battery to determine its condition: The OCV Test and Load Test.

OCV - OPEN CIRCUIT VOLTAGE TEST

Battery voltage should be checked with a digital multitester. Readings of 12.6 volts or less require further battery testing and charging. See charts and Load Test.

To perform an open circuit voltage test, set the digital meter to DC volts and place the tester leads on each battery terminal. Minimum voltage should be 12.4 to 12.7 VDC for a known good battery.

OPEN CIRCUIT VOLTAGE	
State of charge	Maintenance Free
100% Charged	12.6V
75% Charged	12.4V
50% Charged	12.1V
25% Charged	11.9V
0% Charged	less than 11.9V
Self Discharge vs. Temperature	
Temerature	Days to 0% charged
104 F	300
77 F	600
32 F	950

LOAD TEST

CAUTION: ***To prevent shock or component damage, remove spark plug high tension leads and connect securely to engine ground before proceeding.***

NOTE: This test can only be performed on machines with electric starters. This test cannot be performed with an engine or starting system that is not working properly.

A battery may indicate a full charge condition in the OCV test and the specific gravity test, but still may not have the storage capacity necessary to properly function in the electrical system. For this reason, a battery capacity or load test should be conducted whenever poor battery performance is encountered. To perform this test, hook a multitester to the battery in the same manner as was done in the OCV test. The reading should be 12.6 volts or greater. Engage the starter and observe the battery voltage while cranking the engine. Continue the test for 15 seconds. During cranking the observed voltage should not drop below 9.5 volts. If the beginning voltage is 12.6 volts or higher and the cranking voltage drops below 9.5 volts during the test, replace the battery and re-test. Continued low cranking voltage with a known good battery may indicate excess current draw from one or more of the starting components.

OFF SEASON STORAGE

To prevent battery damage during extended periods of non-use, the following basic battery maintenance items must be performed:

- Remove the battery from the machine and wash the case and battery tray with a mild solution of baking soda and water. Rinse with lots of fresh water after cleaning. **NOTE:** Do not get any of the baking soda into the battery or the acid will be neutralized.
- Using a wire brush or knife, remove any corrosion from the cables and terminals.
- **Never add water to a sealed maintenance free battery.**
- Charge at a rate no greater than 1/10 of the battery's amp/hr capacity until the open circuit voltage is 12.9V or greater.
- Store the battery either in the machine with the cables disconnected, or store in a cool place.

CHARGING PROCEDURE

1. Remove the battery from the ATV to prevent damage from leaking or spilled acid during charging.
2. Charge the battery with a charging output no larger than 1/10 of the battery's amp/hr rating. Charge as needed to raise the open circuit voltage to 12.9V or greater.
3. Install battery in vehicle with positive terminal toward the front. Coat threads of battery bolt with a corrosion resistant dielectric grease.

Dielectric Grease

(PN 2871329)

4. Connect the battery cables.

⚠ WARNING

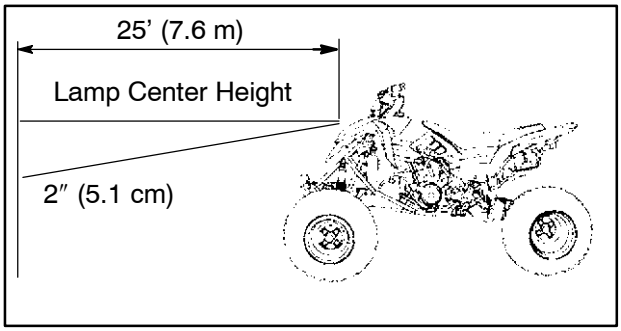
To avoid the possibility of explosion or sparks, connect positive (red) cable first and negative (black) cable last.

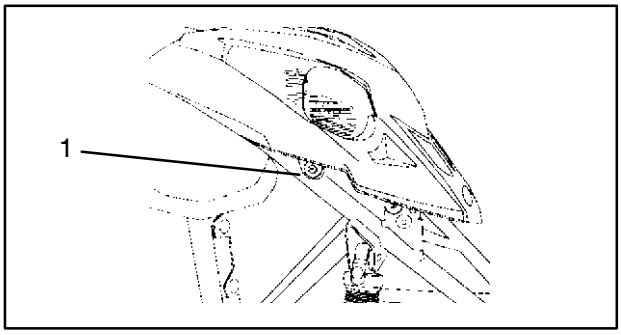
5. After connecting the battery cables, attach the hold down strap.
6. Route cables so they are tucked away in front and behind battery.

HEADLIGHT ADJUSTMENT

The headlight beam can be adjusted to varied positions by using the following procedures:

1. Place the vehicle on a level surface with the headlight approximately 25' (7.6 m) from a wall.

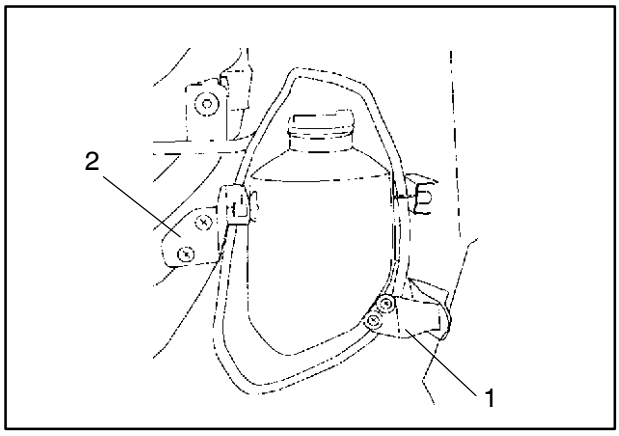




2. Measure the distance from the floor to the center of the headlight and make a mark on the wall at the same height.
3. Start the engine and turn the headlight switch to high beam.
4. Observe headlight aim. The most intense part of the headlight beam should be aimed 2″ (5.1 cm) below the mark placed on the wall in Step 2 **NOTE:** Rider weight must be included on the seat. On machines with separate low beam lights, the drop should be 8″ (20.3 cm) in 25' from the center of the low beam lamp.
5. Loosen the pivot screw (1) and adjust the beam to the desired position.
6. Tighten the screw and torque to 27 in. lbs. (3 Nm).

HEADLIGHT HOUSING REPLACEMENT

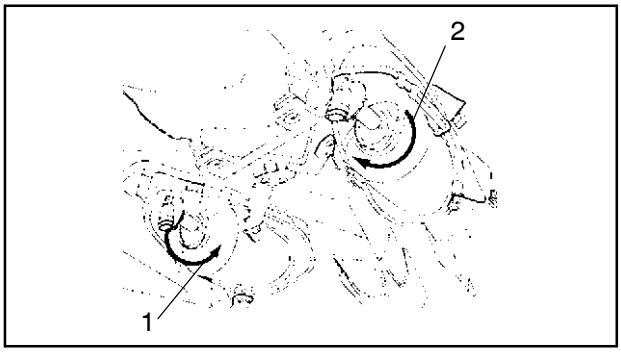
CAUTION: Do not service while headlight is hot. Serious burns may result. Protect lamp during install.



1. Remove the wire harness connector from the headlights.
2. Remove the front cab. Position the cab upside down on a soft protective surface to prevent scratching.
3. Remove the small adjuster bracket (1) and install it on the new lamp.
4. Remove the large pivot bracket (2) and remove the headlamp.
5. Install the new headlamp by inserting the outboard pivot pin in the hole of the mounting tab on the cab.
6. Install the adjuster bracket onto the inboard pivot pin of the headlamp.
7. Adjust for approximately 1/16" clearance between the bracket and the edge of the headlight. Tighten the mounting screws. **IMPORTANT:** Be sure the bracket is 90 degrees to the pivot pin so the lamp can move freely.
8. Install the adjusting screw, leaving it loose so the headlight can be adjusted.
9. Reinstall the front cab and connect the wire harness to the headlamp.
10. Adjust the lamps as needed, then tighten the adjuster screw.

HEADLIGHT LAMP REPLACEMENT

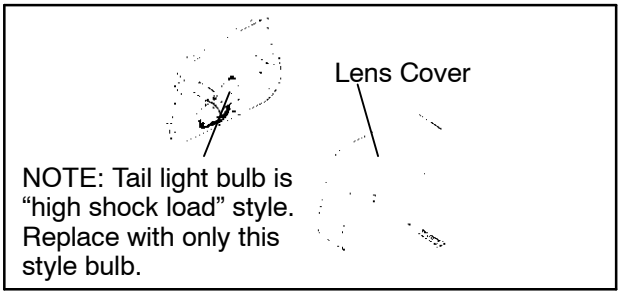
1. Remove the wire harness connector from the back of the headlight.
2. On the left headlamp, grasp the bulb housing and turn it *counterclockwise* (1) to remove the bulb. On the right headlamp, turn the bulb housing *clockwise* (2) to remove the bulb.



3. Apply dielectric grease to the light bulb socket before installing the new bulb. Install the replacement bulb into headlight housing and rotate firmly. **NOTE:** The bulb must be positioned so the harness installs into the lamp at outer side.
4. Reinstall the connector to the back of the headlight.

TAILLIGHT/BRAKELIGHT LAMP REPLACEMENT

If the taillight/brakelight does not work the lamp may need to be replaced.



1. From the rear of the taillight remove two screws holding lens cover in place and remove lens cover.
2. Remove lamp and replace it with recommended lamp. Apply Dielectric Grease **(PN 2871329)** to the new bulb contacts.
3. Reinstall the lens cover removed in step 1.
4. Test the taillight/brakelight to see it is working.

HEADLAMP SWITCH

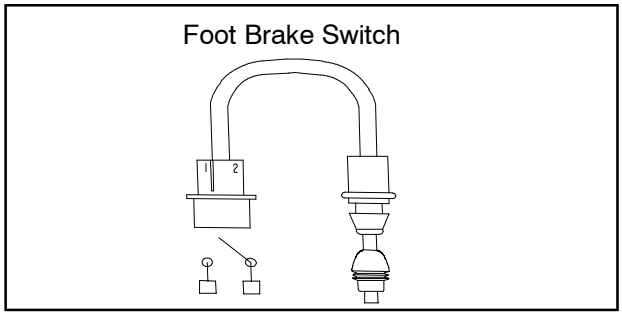
Probe the headlamp plug wires (Brown and Yellow) at back of connector. Turn headlights on. Test for battery voltage across the connections.

- Low Beam – Brown and Green
- High Beam – Brown and Yellow

BRAKE LIGHT SWITCHES

Foot Brake

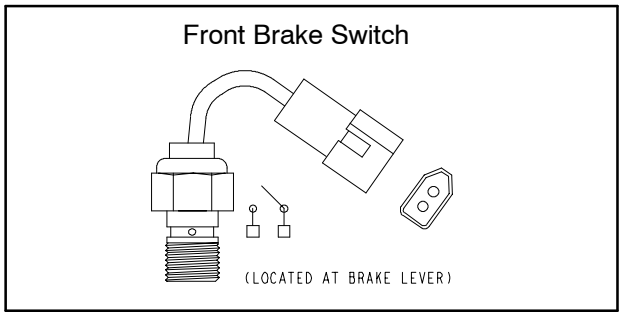
1. Disconnect wire harness from switch.



2. Connect an ohmmeter across switch contacts. Reading should be infinite (∞).
3. Apply foot brake and check for continuity between switch contacts. Replace switch if there is no continuity or greater than .5 ohms resistance when the brake is applied with slight pressure.

Front Brake

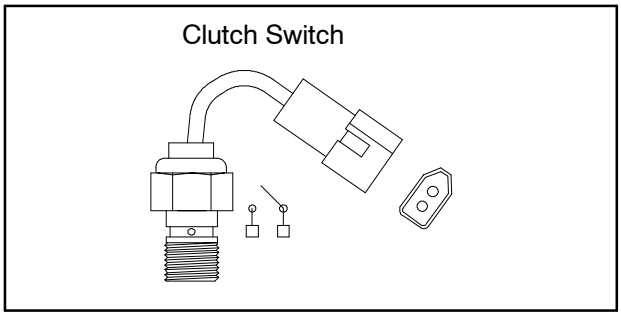
1. Disconnect wire harness from switch.



2. Connect an ohmmeter across switch contacts. Reading should be infinite (∞).
3. Apply front brake lever and check for continuity between switch contacts. Replace switch if there is no continuity or greater than .5 ohms resistance when the brake is applied with slight pressure.

CLUTCH SWITCH TEST

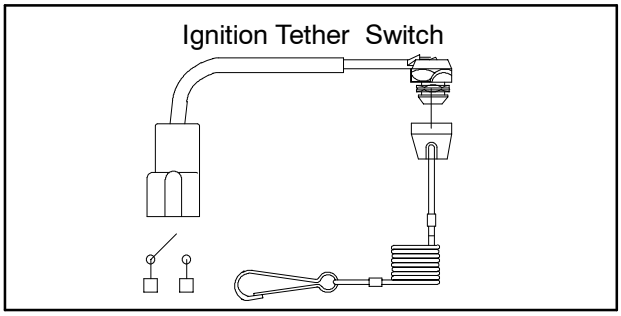
1. Disconnect the switch by pulling apart the switch bullet connector.



2. Using an ohmmeter set to the ohms scale, connect one lead to ground and one lead to the switch bullet connector. Replace switch if there is no continuity or greater than .5 ohms resistance.

TETHER SWITCH (ACCESSORY)

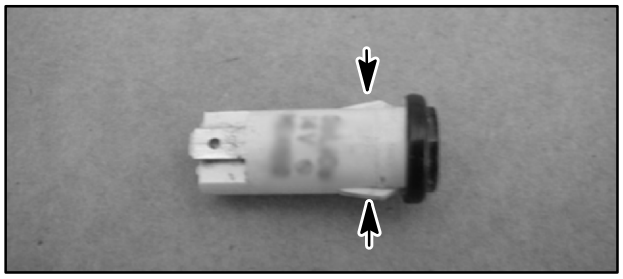
1. Disconnect wire harness from switch.



2. Connect an ohmmeter across switch contacts. Reading should be infinite (∞).
3. Pull tether boot from switch and check for continuity between switch contacts. Replace switch if there is no continuity or greater than .5 ohms resistance.

INDICATOR LAMP REPLACEMENT

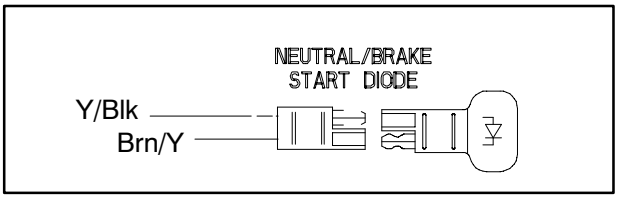
1. Gain access to the lamps by disconnecting the ignition switch harness, then expose and remove the two T25 pod assembly screws under the decorative trim buttons. Turn pod over.
2. Disconnect the wires of the lamp to be removed. Remove indicator lamp from the panel by depressing the lamp holding tangs with a pliers while pushing the assembly out of the pod.



3. Push the new lamp into pod assembly. Reconnect wiring and reattach the pod assembly to the handlebar mount. Tighten screws to 27 in. lbs. (3 Nm)

NEUTRAL START DIODE TEST

1. Disconnect diode from harness.
2. Using an ohm meter, test for continuity each way. The diode should only read continuity one direction if it is working properly.



3. Should the diode test good and there is still a problem, check the clutch switch, wiring and harness connections.

STARTER SYSTEM TROUBLESHOOTING

Starter Motor Does Not Turn

- Battery discharged. Low specific gravity
- Loose or faulty battery cables or corroded connections (see Voltage Drop Tests)
- Related wiring loose, disconnected, or corroded
- Poor ground connections at battery cable, starter motor or starter solenoid (see Voltage Drop Tests)

- Faulty key switch
- Faulty kill switch
- Faulty starter solenoid or starter motor.
- Engine problem - seized or binding (Can engine be rotated easily ?)
- **NOTE:** The Predator will not push start or key start if the battery is disconnected or completely dead.

Starter Motor Turns Over Slowly

- Battery discharged
- Excessive circuit resistance - poor connections (see Voltage Drop Test below)
- Engine problem - seized or binding (Can engine be rotated easily?)
- Faulty or worn brushes in starter motor
- Automatic compression release inoperative

Starter Motor Turns - Engine Does Not Rotate

- Faulty starter drive/one way clutch
- Faulty starter drive gears or starter motor gear
- Faulty flywheel gear or loose flywheel
- Possible engine damage

STARTER VOLTAGE DROP TESTING

A Voltage Drop Test tests for bad connections. When performing the procedure, you are testing the amount of voltage drop through the connection. A poor or corroded connection will appear as a high voltage reading. Voltage shown on the meter when testing connections should not exceed .1 VDC per connection or component.

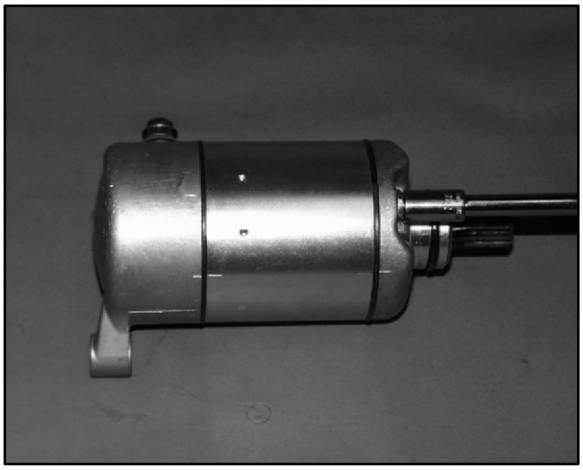
To perform the test, place the meter on DC volts and place the meter leads across the connection to be tested. Refer to the chart on 10.21 to perform voltage drop tests on the starter system.

Voltage should not exceed .1 DC volts per connection

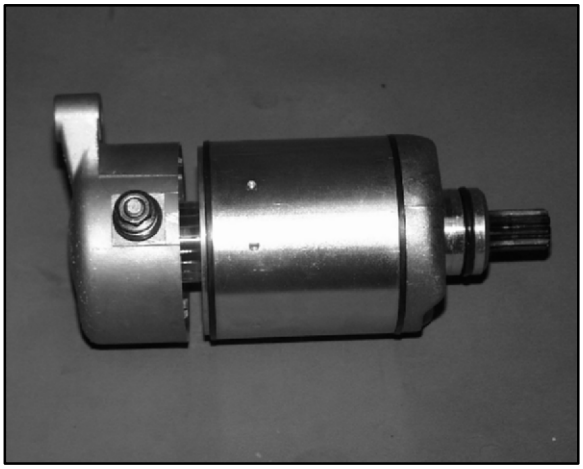
STARTER MOTOR DISASSEMBLY

Use only electrical contact cleaner to clean starter motor parts. Some solvents may leave a residue or damage internal parts and insulation.

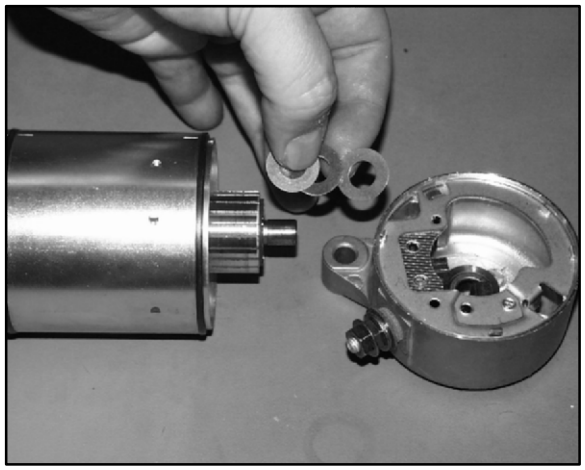
1. Note the alignment marks on both ends of the starter motor casing. These marks must align during reassembly.



2. Remove the two bolts, washers, and sealing O-Rings. Inspect O-Rings and replace if damaged.

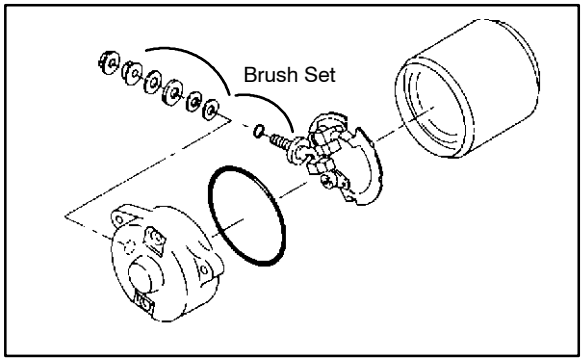


3. Remove brush terminal end of housing while holding other two sections together.

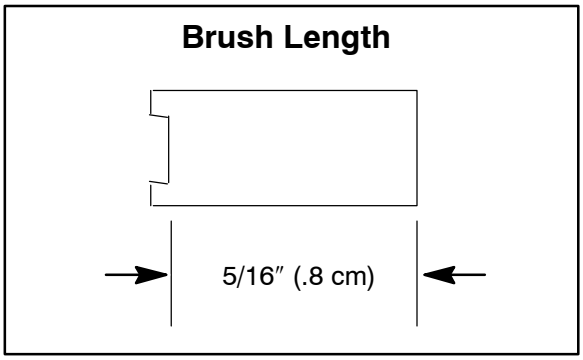


4. Remove shims from armature shaft. **NOTE:** All shims must be replaced during reassembly.

BRUSH INSPECTION/REPLACEMENT

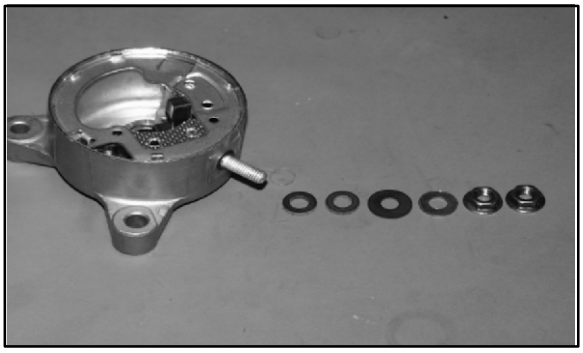


1. Using a digital multitester, measure the resistance between the cable terminal and the insulated brush. The reading should be .3 ohms or less.
2. Measure the resistance between the cable terminal and brush housing. Make sure the brush is not touching the case. The reading should be infinite.
3. Remove nut, flat washer, large phenolic washer, two small phenolic washers, and O-Ring from brush terminal. Inspect the O-Ring and replace if damaged.



Brush Length Service Limit: 5/16″ (.8 cm)

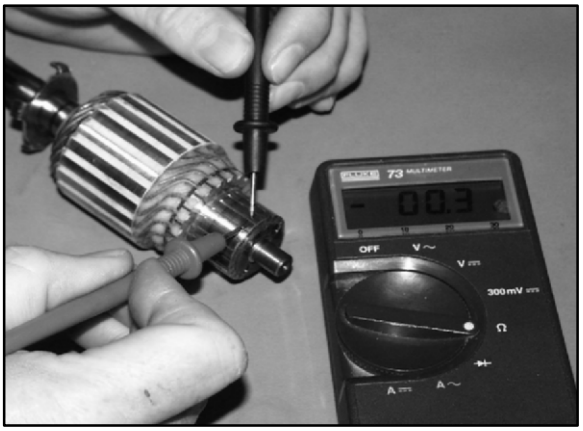
4. Remove brush plate and brushes. Measure length of brushes and replace if worn past the service limit. Replace springs if they are discolored or have inadequate tension.
5. Inspect surface of commutator for wear or discoloration. See Steps 3-6 of armature testing on Page 7.18.
6. Install a new carbon brush assembly in the brush housing. **NOTE:** Be sure that the terminal bolt insulating washer is properly seated in the housing, and the tab on the brush plate engages the notch in the brush plate housing.
7. Place a wrap of electrical tape on the threads of the terminal bolt to prevent O-Ring damage during reinstallation.
8. Install the O-Ring over the bolt. Make sure the O-ring is fully seated.



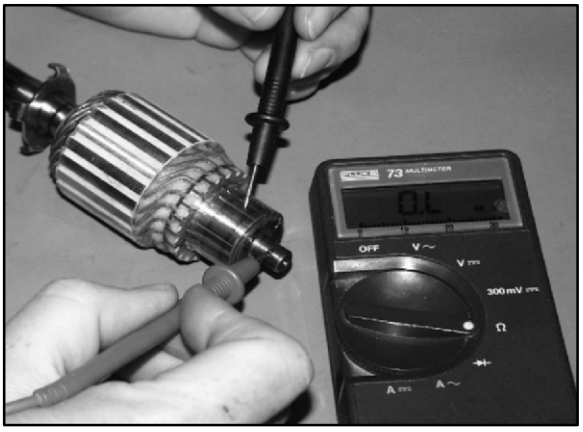
9. Remove the electrical tape and reinstall the two small phenolic washers, the large phenolic washer, flat washer, and nut.

ARMATURE TESTING

1. Remove armature from starter casing. Note order of shims on drive end for reassembly.
2. Inspect surface of commutator. Replace if excessively worn or damaged.



3. Using a digital multitester, measure the resistance between each of the commutator segments. The reading should be .3 ohms or less.



4. Measure the resistance between each commutator segment and the armature shaft. The reading should be infinite (no continuity).
5. Check commutator bars for discoloration. Bars discolored in pairs indicate shorted coils, requiring replacement of the starter motor.
6. Place armature in a growler. Turn growler on and position a hacksaw blade or feeler gauge lengthwise 1/8″ (.3 cm) above armature coil laminates. Rotate armature 360°. If hacksaw blade is drawn to armature on any pole, the armature is shorted and must be replaced.

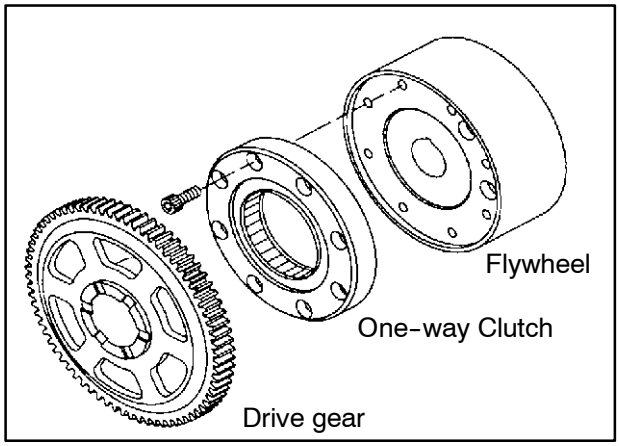
STARTER REASSEMBLY

1. Place armature in field magnet casing.
2. Place shims on drive end of armature shaft with phenolic washer outermost on shaft. Engage tabs of stationary washer in drive end housing, holding it in place with a light film of grease.
3. Install case sealing O-Ring. Make sure O-Ring is in good condition and not twisted on the case. Lubricate needle bearing and oil seal with a light film of grease, and install housing, aligning marks.
4. Install O-Ring on other end of field magnet casing. Make sure it is in good condition and not twisted on the case.
5. Align casing marks and install housing, pushing back brushes while installing shaft in bushing.
6. Reinstall starter motor housing bolts. Make sure O-Rings are in good condition and seated in groove.

7. Inspect permanent magnets in starter housing. Make sure they are not cracked or separated from housing.

CAUTION: Use care when handling starter housing. Do not drop or strike the housing as magnet damage is possible. If magnets are damaged, starter must be replaced.

STARTER ONE-WAY CLUTCH INSPECTION



1. Inspect the drive gear teeth, bearings and thrust surfaces for excessive wear or damage.
2. Inspect the one way drive clutch rollers and springs for excessive wear or damage.
3. Proper function can be determined by rotating the drive gear counterclockwise, which will engage the one-way clutch rollers and turn the flywheel. During engine rotation, there should be no chattering or hanging of the drive gear and one-way clutch. Should this occur, replace one or both components and retest. Refer to Chapter 3 for the proper torque specifications and assembly procedures.

STARTER SYSTEM TESTING FLOW CHART

Condition: Starter fails to turn motor. **NOTE:** Make sure engine crankshaft is free to turn before proceeding with dynamic testing of starter system. A digital multitester must be used for this test.

With the tester on the VDC position, place the tester's black lead on the battery negative and the red lead on the battery positive.

Reading should be 12.5 VDC or greater.

→ No → Remove battery and properly service. Install fully charged shop battery to continue test.

Yes

Disconnect White/Red engagement coil wire from the starter solenoid. Connect tester black wire to battery ground. Connect red tester lead to White/Red harness wire at solenoid. Turn on ignition switch and depress the starter button. Tester should read battery voltage.

→ No → Check voltage on both sides of circuit breaker, ignition switch/engine stop switch and starter button. The voltage on both sides should be the same. **NOTE:** The ignition switch must be on and the engine switch turned to "RUN". Check the clutch and neutral safety start circuits, as they supply the ground path for solenoid operation. Replace the defective component(s) or wiring.

Yes → Test starter solenoid coil by connecting an ohmmeter between the solenoid red wire and the solenoid mounting plate. Resistance should be 3.4Ω. Check solenoid ground path by measuring resistance between mounting plate and battery negative terminal (-).

Voltage Drop Testing

See Page 7.16 for information.

Reconnect the solenoid. Connect the tester black lead to the battery positive and the red lead to the solenoid end of the battery-to-solenoid wire. Depress starter button. Reading should be less than .1 V D.C.

→ No → Clean the battery-to-solenoid cable ends or replace the cable.

Yes

Connect the black tester lead to solenoid end of battery-to-solenoid cable. Connect red tester lead to solenoid end of solenoid-to-starter cable. Depress starter button. Reading should be less than .1 V D.C.

→ No → Replace the starter solenoid.

Yes

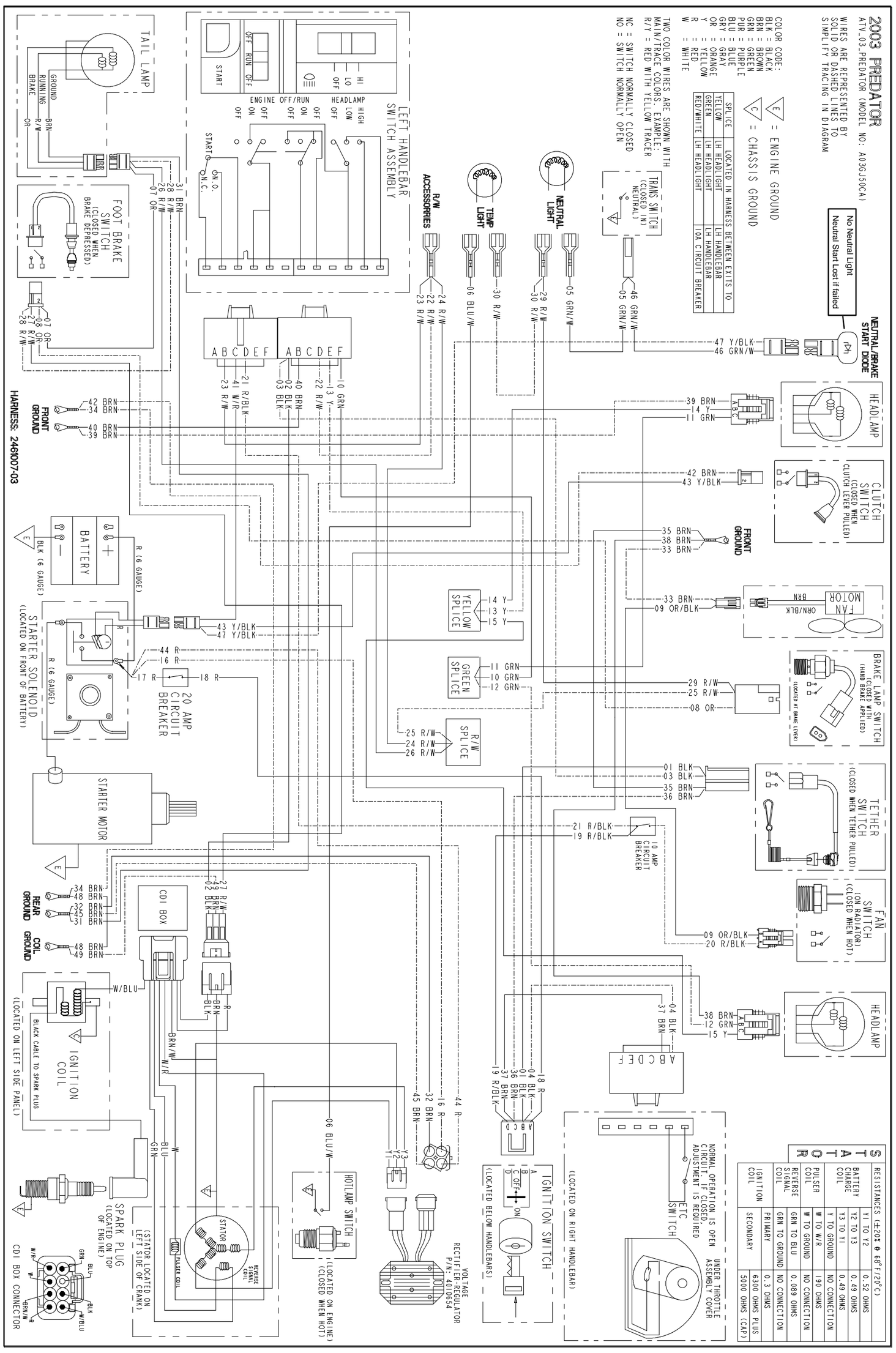
Connect the black tester lead to the solenoid end of the solenoid-to-starter cable. Connect the red tester lead to the starter end of the same cable. Depress the starter button. The reading should be less than .1 V D.C.

→ No → Clean the solenoid-to-starter cable ends or replace the cable.

Yes

If all of these indicate a good condition, yet the starter still fails to turn, the starter must be removed for static testing and inspection.

WIRING DIAGRAM 2003 PREDATOR



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